

INTERNATIONAL

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French President Valéry Giscard d'Estaing (left) and West German Chancellor Helmut Schmidt (right) listen to Danish Premier Anker Joergensen during opening ceremonies of the Copenhagen European Economic Community summit conference.

## At Copenhagen Summit Talks

## EEC Leaders Set Community Vote Date

**From Wire Dispatches**  
COPENHAGEN, April 7 (UPI)—European Economic Community leaders agreed today that the first direct elections to the European Parliament will be held in June of next year. British Foreign Secretary David Owen announced.  
The date—June 7 to 10—was decided as the leaders began a summit conference aimed at stabilizing their currencies and promoting greater economic growth.

The elections, originally due to have been held in May and June of this year, were postponed because of legislative delays in Britain and other EEC countries.

The conference was the first of three gatherings in coming months to discuss economic problems and the growing dangers of world protectionism. The leaders will meet again in Bremen early in July shortly before the world economic conference in Bonn which President Carter will attend.

### Decline of Dollar

The heads of state and government, accompanied by their foreign ministers, were seeking solutions to problems posed by the decline of the dollar, growing unemployment in the Common

Market and the community's failure to achieve a respectable overall growth rate.

But first, the meeting dealt with purely Community matters—the setting up of a foundation, probably in France, to promote European unity; the fixing of a date next summer for the first communitywide elections and the issuing of a declaration on the democratic principles of the community.

"This will be the best prepared summit meeting and we hope for positive results," Danish Foreign Minister Knud Andersen said. "The situation in the world is so serious that it is imperative that we have thorough negotiations at the summit and that we lay the basis for further negotiations this summer [at the world economic meeting in Bonn]," he said.

### High Unemployment

With 6 million unemployed throughout the Common Market and the situation getting worse, unemployment ranks high among the priorities as the Community leaders assembled in one of a regular series of three-yearly meetings.

The leaders were scheduled to discuss a broad range of economic, monetary and international issues, including trade with Japan, relations with the developing countries, energy, the growing tendency towards protectionism and the means of stimulating economic growth.

fueled Palestinian resentment. The Palestinians argue that the UN presence should be limited to Israeli outposts to prepare for Israel's withdrawal from Lebanon.

The Norwegians established a new roadblock and fortified a road near Kaubaba yesterday. A Norwegian soldier was slightly wounded in apparent mortar crossfire between the Palestinians and Israeli positions further south.

The flare-up occurred as UN officials arrived in Beirut for talks on logistical and administrative details of the UN presence. The UN officers, under instructions from Maj. Gen. Emmanuel Erskine, commander of the UN peace-keeping force, "contacted several persons in an effort to stop the south Lebanon clashes," UN sources said. They said that Gen. Erskine would proceed to the Kaubaba area to help restore peace.

Israel to Begin Withdrawal  
TEL AVIV, April 7 (AP)—Israel will begin a two-stage partial (Continued on Page 2, Col. 4)

### 1st Major Duel in Southern Lebanon

## Palestinians Said to Fire on UN Unit

BEIRUT, April 7 (UPI)—Palestinians firing on United Nations troops sparked an hour duel in southeastern Lebanon today, the first major fighting involving the UN peacekeeping force, guerrilla and UN sources said.

They said that Palestinian artillery fired on UN positions near the town of Kaubaba. The UN troops responded with light and medium machine-gun fire, guerrilla sources said. There were no reports of casualties.

The UN force entered Lebanon following the Israeli invasion two weeks ago. There was no immediate indication as to what had prompted the Palestinian fire. But diplomats in Beirut speculated that it may have come from radical Palestinian factions who believe that the UN force is not insuring Israel's withdrawal.

### PLO Criticism

The Palestine Liberation Organization said here, "We consider the Israeli announcement on withdrawal a trick and part of the U.S.-Israeli conspiracy in this country. We believe that Israel

has no excuse for prolonging its occupation."

Norwegian UN troops are stationed in the Kaubaba area. Diplomats noted that there were no Israeli forces in this area and speculated that this may have

### Reporter Loses Suit In U.S. Wiretapping

WASHINGTON, April 7 (UPI)—A Federal District Court judge yesterday dismissed a civil suit that Hedrick Smith, Washington bureau chief of The New York Times, had brought against former President Richard Nixon and several former government officials. Judge John Smith Jr. said that they had had a "good-faith basis" for a wiretap that was placed on Mr. Smith's home telephone in 1969. He added that it had been maintained within the Justice Department's guidelines for national security surveillances. Mr. Smith, who was diplomatic correspondent for The Times when the tap was placed, had asked the court to rule that the surveillance was illegal.

### 1st Action by Interim Government

## Rhodesia to Release Political Detainees

SALISBURY, Rhodesia, April 7 (UPI)—Several hundred black political detainees, incarcerated without trial by Prime Minister Ian Smith's former government, are to be released as part of Rhodesia's "internal" majority rule agreement.

The move—the first concrete step taken since the agreement was signed March 3—was announced yesterday by the executive council of the pre-majority rule interim government. The council is composed of Mr. Smith and three Rhodesia-based black leaders, one of whom, the Rev. Ndabeni Sibhale, was himself a detainee in the 1960s. A statement said that 24 detainees already have been released. Though initially restricted in their movements, "all restrictions upon them will be withdrawn," it said. Orders authorizing the release of several hundred more detainees will be signed and processed next week, the statement said.

### Confrontation Expected

The announcement preceded an expected confrontation of the interim government with Britain and the United States over the U.S.-British call for a new Rhodesia conference of all interested parties, including the militant

guerrilla-backed Patriotic Front. An U.S.-British diplomatic team was expected here soon—possibly tonight or tomorrow. John Graham, deputy under secretary at the British Foreign Office, and Stephen Low, the U.S. ambassador to Zambia, have been assigned to persuade the interim government to take part in the proposed conference later this month.

The government has said that it will consider "constructive ideas" but that the internal settlement cannot be renegotiated.

It has said that Washington and London, instead of pushing their own majority rule plan, should persuade the Patriotic Front to join the internal agreement. But the Front calls the settlement a "sellout."

### Conditions on Release

The announcement on the detainees said that "many of them are now prepared to support a cease-fire and work within the principles of the [internal] agreement," and that "release will be phased and will be subject to essential security safeguards." Those freed must promise not to take part in subversive activities, it said.

The statement said without citing figures that "the release of a

substantial number of detainees" is envisaged. Authoritative reports have put the number of persons in detention at about 1,000.

Joshua Chinamano, leader of the Patriotic Front-affiliated African National Council-Zimbabwe, said that, to his knowledge, no members of his party were among the 254 detainees recently freed.

Meanwhile, James Chikema, vice-president of one of the black organizations taking part in the internal settlement, said that members of Mr. Chinamano's group recently tried to beat a section leader of his own United African National Council.

And he warned: "The [black] government that will emerge after Dec. 31 [when a full power transfer is to take place] will not tolerate that kind of fooling around. It will deal with them. Those will be African politics and African politics are tough."

### Angry Reaction

SALISBURY, April 7 (AP)—Conservative white Rhodesians reacted angrily today to the announcement on the release of the political prisoners. And some blacks were asking why all political detainees are not to be released.

## Reserves Option

# Carter Puts Off Neutron, Awaits Soviet 'Restraint'

By Fred Farris

WASHINGTON, April 7 (UPI)—President Carter announced today that he will defer production of neutron weapons and await signs of Soviet "restraint" in their construction and deployment of nuclear and conventional arms and forces.

Mr. Carter, in a statement announcing his long-awaited decision, said that "the ultimate decision" on whether to produce such enhanced radiation weapons "will be made later" and "will be influenced" by Soviet "restraint" in its conventional and nuclear arms programs and force deployments affecting the security of the United States and Western Europe.

The President said that he had ordered the Defense Department to proceed with the modernization of nuclear warheads for the Lance missile and 8-inch artillery but was "leaving open the option of installing the enhanced radiation elements."

the production of neutron warheads has therefore become a "hargaining chip" in U.S. negotiations with the Russians on strategic arms limitation.

Neutron weapons kill primarily by radiation and generate less blast and heat than current nuclear weapons. They would, in the opinion of NATO strategists, be most effective against a massed tank attack that Soviet or War-

saw pact forces might launch against Western Europe.

But opponents of the system argue that its reduced blast and devastation effects would make it more tempting for commanders to use, thereby lowering the "threshold" of nuclear war.

The now-deferred neutron artillery shells were designed to replace aging 8-inch and 155-mm shells that have been deployed in

Europe for almost 20 years. The modernization program that Mr. Carter ordered would produce shells for either a neutron or a traditional nuclear version of the weapon, sources said.

Because of the complexities of such weapons, it would be a year or more from the start of such a program before a decision would (Continued on Page 2, Col. 5)

## Brezhnev: U.S. Delaying SALT

MOSCOW, April 7 (UPI)—Soviet President Leonid Brezhnev today accused the United States of using the neutron bomb as a hargaining chip in the Strategic Arms Limitation Talks and said that President Carter was stalling on a new arms agreement for "political reasons."

Speaking from the deck of a Navy ship in the Pacific off Vladivostok, where he and former

President Ford agreed in 1974 to negotiate a new strategic arms treaty, Mr. Brezhnev delivered one of his sharpest criticisms over the failure of the two superpowers to reach a new SALT agreement.

"Almost three and a half years have passed since that time and the agreement has not yet been signed," Mr. Brezhnev said. "The sides are capable of finding a so-

lution to what would seem to be the most complex problems—and the documents that are being prepared now are largely agreed upon and thrashed out. If the final conclusion of this work is, nevertheless, being delayed, this is evidently for political reasons."

The text of Mr. Brezhnev's speech was issued only hours after news of Mr. Carter's decision (Continued on Page 2, Col. 5)

### NATO Consulted

Mr. Carter said that the United States was consulting its NATO partners on his decision to put off—but not cancel—production of the neutron weapons, adding that his administration "will continue to discuss with them appropriate arms control measures to be pursued with the Soviet Union."

Mr. Carter said that the United States "will continue to move ahead with our allies to modernize and strengthen our military capabilities, both conventional and nuclear." He added: "We are determined to do whatever is necessary to assure our collective security and the forward defense of Europe."

By inviting Soviet "restraint" in its military build-up, Mr. Carter clearly signaled Moscow that he was waiting for action that would make it unnecessary to order neutron warheads into production.

### No Soviet Production

Previous public statements calling on the Russians to offer an inducement to halt U.S. neutron production were answered only with announcements that they would not build neutron weapons of their own.

The Soviet Union had vigorously denounced the anticipated U.S. production of such weapons and had organized demonstrations in protest.

Mr. Carter's decision to defer



William Whitelaw, who announced Conservatives' plan for limiting immigration into Britain.

## In Conservative Party Proposals

# Tough U.K. Race Curbs Urged

LONDON, April 7 (Reuters)—Britain's opposition Conservative party today announced tough proposals for curbing colored immigration.

Deputy Party Leader William Whitelaw outlined plans for an overall quota limiting immigration and a ban on immigration by

husbands and fiancées of Commonwealth women.

His party also plans a register of dependents in the Indian subcontinent who wish to join heads of households here, tougher restrictions on their entry and fewer work permits for foreigners.

Race has become a hot political issue in Britain and the proposals are likely to provoke protests and political clashes.

The Labor government yesterday said it would make no radical changes in immigration regulations. The parties' rival policies face a crucial test in an April 20 by-election in the inner London area of Brixton, which has a large black population.

### Harsher Than Expected

The Conservative proposals, which contain eight policy changes, are harsher than expected.

Mr. Whitelaw told a Conservative conference in Leicester that they would be implemented by his party if it wins the next general election, which must take place within 18 months; and is widely expected to be held this fall.

The heated political argument about race started when Conservative leader Margaret Thatcher said that many Britons feared they might be swamped by the colored population.

Yesterday Home Secretary Merlyn Rees denied that this could happen and said that colored immigration last year was 28,000—a drop of 25 per cent from 1976.

Britain's colored community numbers 1.9 million, about 3.5 per cent of the population, and is mainly composed of Indians, Pakistanis, Asians from east Africa, blacks from the Caribbean, and their descendants.

### Called Gross Affront

The Conservative proposals were immediately attacked by immigrant leaders. One of them said they were a gross affront to the Indian people.

Jagmohan Joshi, national secretary of the Indian Workers Association, said: "They are devised to cause psychological disturbances, emotional upsets and the permanent division of families."

Kanti Nagji, secretary general of the Confederation of Indian

Organizations U.K., said that the proposed register of dependents would mean immigrants registering themselves. "It is like requiring one racial group to carry identity cards. The Indian community will be very, very angry over this package," he said.

## Portugal Says Food Rationing Possible in '79

LISBON, April 7 (AP)—Portugal will be forced to ration food next year if it does not start to produce more, Trade Minister Basilio Horta warned today.

Announcing big increases in the prices of subsidized food items, Mr. Horta said that the government could not go on paying for imports at the present rate. "Supplies will run out next year if we do not become more productive," he said.

Prices of a "shopping basket" of essential items were raised between 10 and 35 per cent from last year, the minister said. He said that the package would be expanded to include chicken, eggs and other items produced locally.

But imported meat, especially beef, no longer will be subsidized, he said. The public would be encouraged to eat pork, which was in surplus last year.

The price increases follow rises of up to 50 per cent in transport, gas and electricity charges. Tax revenue is to be increased by about a third in a drive to halt the slide in the country's ailing economy.

## Metalworkers End West German Strike

STUTTGART, April 7 (AP)—Striking metalworkers in the state of Baden-Wuerttemberg approved a compromise contract settlement yesterday, ending their three-week strike, a union spokesman said.

A spokesman for the union said that about 93,000 workers had voted in favor of the contract, which includes a 5 per cent raise.



Mrs. Benigno Aquino, wife of the jailed opposition leader, votes in suburban Quezon City.

## Test of Strength for Marcos Regime

# Turnout Heavy in Philippines Elections

MANILA, April 7 (UPI)—Filipinos turned out in large numbers today to vote in the country's first martial-law national elections, which have been seen as a test of strength for the regime of President Ferdinand Marcos.

The voting was for 165 elective seats in the Interim National Assembly, considered as the forerunner of a regular parliament. Results are expected tomorrow.

Officials estimated the turnout at between 80 to 90 per cent of the 22 million registered voters. Early this evening, the only major report of violence came from Zamboanga Del Sur province, 500 miles south of Manila, where suspected Muslim rebels ambushed a B.F. Goodrich Co. truck carrying company workers to the polls, killing four and wounding 10.

Political interest was centered in the populous Manila region where Mr. Marcos's wife, Imelda, headed the administration ticket against an opposition slate led by imprisoned opposition leader Benigno Aquino Jr.

Twenty-one seats are at stake in the Manila region, where opposition forces mustered their strength, leaving the other areas virtually uncontested for government candidates.

Police officials described the (Continued on Page 2, Col. 2)



## After Failure of Air Escape

## Muscovite to Try Again to Flee

MOSCOW, April 7 (AP)—A Russian woman seeking to rejoin her defector husband in Sweden declared today that she would keep striving to leave the Soviet Union despite the failure of an airplane escape attempt.

Describing the abortive scheme, Ludmila Agapova told Western correspondents that "only the groundless cruelty of the Soviet authorities forced us to take this step."

Soviet officials had repeatedly denied appeals by Mrs. Agapova, 39, to be reunited with her husband, Valentin, a Soviet merchant sailor who defected to Sweden in 1974.

Mrs. Agapova told how she, her two-year-old daughter and elderly mother-in-law spent several cold, wet winter nights in an open shelter near a lake about 25 kilometers from the Soviet-Finnish border while awaiting the plane which was to rescue them.

On three occasions — oo



Ludmila Agapova

March 11, March 12 and March 19 — the escape plane failed to show, she said, while on the fourth and last attempt, last Sat-

urday, the aircraft arrived about 1 1/2 hours before the trio had reached the lake rendezvous spot.

## Pilot Arrested

The plane's pilot, Karl-Goran Wickenberg, and another Swede were arrested by Finnish police after they returned from the unauthorized flight into Soviet territory.

The airplane, a Piper Cub, was to have touched down on the ice covering the lake, located near the town of Priozersk, about 140 kilometers north of Leningrad.

But Mrs. Agapova said that even if the timing had been correct on the final try, executing the escape probably would have been impossible because warmer weather had by then melted the ice along the shore of the lake.

Until 1975, Mrs. Agapova worked as a mechanical engineer specializing in acoustical insulation for machinery. She was fired two months ago from her last job, as a laundry cleaner. And Wednesday, after she returned home, she was told by a Soviet KGB political police officer that she could be prosecuted for "parasitism."

This is a charge frequently brought against Soviet dissenters and would-be Jewish emigrants after they have lost their jobs.

## Official's Remark

Mrs. Agapova said that a key factor in the decision to attempt the airborne escape was a Soviet official's remark during an interview in Sweden last summer that defectors such as her husband would never see their wives and families again.

"After I learned of the interview, I realized that the only way to rejoin my lawful husband was to escape from the Soviet Union," she said.

Previously, Mrs. Agapova had tried sending appeals to the United Nations, going on hunger strikes and taking other steps — all to no avail.

She expressed the hope that Finnish authorities would not deal harshly with the Swedes arrested in connection with the attempt.



NOT QUITE RIGHT—This locomotive which appears to be doing a balancing act near Bell Haven, N.Y., is a real show stopper — the whole show from Buffalo to Binghamton. It got that way when the four freight cars it was pulling were derailed, wrenching it violently off the tracks.

## NATO Assesses U.S. Decision

## Allies See Neutron Move Forcing Soviet Restraint

BRUSSELS, April 7 (UPI)—President Carter's decision to defer production of the neutron weapon should convince the Warsaw pact to show restraint in its arms programs and force deployments, NATO Secretary-General Joseph Luns said today.

Ambassadors of the 15 NATO nations were informed of Mr. Carter's decision at a private meeting. While expressing "understanding for the U.S. decision," the allies said that any further action would depend on the restraint shown by the Soviet Union.

At the same time, they stressed the need to "modernize NATO's military capabilities, both conventional and nuclear," Mr. Luns said.

Mr. Luns said that the ambassadors "reiterated their concerns about the increasing offensive capabilities of Soviet conventional forces and with the continued expansion and improvement of offensive Soviet nuclear forces."

"Need to Modernize" "They therefore stressed the need to modernize NATO's military capabilities, both conventional and nuclear. In this connection, the allies noted that the United States intended to proceed with the modernization of the Lance (missile) system and of the 8-inch gun, leaving open the installing of enhanced-radiation (neutron) elements."

"At the same time, the allies have to be made about the kind of shell it would be. No Trade-off Proposal No specific proposal on arms trade-offs will be made to the Soviet Union, sources said, and no time limit was put on the neutron deferral.

But they said that a continued upgrading of Soviet or Warsaw Pact forces on the NATO front or a refusal by the Russians to enter into any proposed negotiations could trigger the order to build neutron shells.

"The option to go ahead is a real option," an administration official said.

The shape of Mr. Carter's decision seems to meet the demands of West German Chancellor Helmut Schmidt, who, beginning last December, sought an attempt at an arms trade-off with the Soviets.

Plans for the phased withdrawal, which would be completed by Friday, were presented to the chief of UN operations in the Middle East by Lt. Gen. Mordechai Gur, Israel's chief of staff, during a meeting in Jerusalem yesterday.

The first stage of the pullout will affect an area east of Marjoun, a Christian-held town three miles north of the Israeli border, the UN spokesman said. The Israeli troops also will withdraw from the Khazdali bridge over the Litani River, he added.

Begin Rejects Total Pullout JERUSALEM, April 7 (UPI)—Prime Minister Menachem Begin said yesterday that Israel will not stand for total withdrawal to the pre-1967 borders in a peace settlement.

They will be the first beneficiaries under what amounts to a general amnesty for political offenders announced Wednesday by President Augusto Pinochet.

The total number of prisoners affected could eventually exceed 500, according to diplomats and Catholic Church officials.

## Raises Doubts on Key Amendment

## Panama May Challenge Treaty

By Robert G. Kaiser

WASHINGTON, April 7 (WP)—The government of Panama has circulated a statement to members of the United Nations raising the possibility that it will challenge or even reject a key amendment to the first Panama Canal treaty approved last month by the Senate.

The move raises new uncertainty about the fate of the Panama Canal treaties as their supporters in the Senate have become increasingly confident of winning two-thirds approval for the second treaty now being debated.

It was already clear that Panama disliked the disputed "DeConcini reservation" to the first treaty. That reservation, introduced by Sen. Dennis DeConcini, D-Ariz., spells out a U.S. right to intervene in Panama to keep the canal operating at any time after the year 2000, when Panama would assume full control over the canal.

The letter that Panama has circulated at the United Nations — and, reportedly, a second letter sent by Panamanian leader, Gen. Omar Torrijos, to certain heads of state — goes beyond mere dislike and suggests that Panama may find the reservation unacceptable. If that happens, the treaty could not be properly ratified, and the long effort to resolve the future of the canal by negotiations could reach an impasse.

## U.S. Officials Worried

The Carter administration is worried by this turn of events, officials said yesterday, but not alarmed. Several official sources said that Gen. Torrijos has not yet made his intentions clear.

Some theorized that Gen. Torrijos is trying to pressure the Senate not to make any more significant changes in the treaties. Others suggested that he might be responding to domestic opponents who have attacked the DeConcini reservation. Still others felt that he might be trying to assess international opinion toward a Panamanian rejection of the reservation.

Columist Carl Rowan reported in Washington Wednesday night that Panama had already told the United States that it could not accept the DeConcini reservation, but administration officials denied this yesterday.

## Awaits Signs of Soviet 'Restraint'

## Carter Puts Off Production of Neutron

(Continued From Page 1)

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before publicly agreeing to deployment of neutron shells or warheads on German soil. Problems in getting Mr. Schmidt and his government to guarantee their support for production and deployment influenced Mr. Carter's reversal of his earlier plan to go ahead immediately with neutron production.

Unique Weapons The now-deferred neutron shells and warheads would be, if built, the first tactical nuclear weapons designed to kill enemy troops primarily through radiation rather than by destroying their tanks and equipment.

Because they reduce blast and heat, proponents argue that they cause less collateral damage to towns and cities near the battlefield.

Production of the weapons was first approved by President Ford in November, 1976 — a decision

that Panama has told them several times how much it dislikes the DeConcini reservation. Panamanian and U.S. officials have discussed ways to "put a good face on it," an official said.

## Concern Expressed

Yesterday, Panama's ambassadors to the United States, the United Nations and the Organization of American States expressed their concern about the situation in Panama as a result of the DeConcini reservation to Sens. Alan Cranston, D-Calif., and Frank Church, D-Idaho, two key treaty supporters.

Demonstrations were scheduled today in Panamanian City to protest the reservation.

U.S. Ambassador William Jordan to Panama informed Washington that the situation there is very bad, according to a source.

Several Latin American governments are upset by the DeConcini reservation. President Carlos Perez of Venezuela told President Carter in Caracas last

week that he hoped the President could do something to mitigate the reservation's impact.

Some Latin American diplomats have suggested that some governments may refuse to ratify the treaty on the canal's neutrality, which will be open to adherence by all states, as a form of protest against the reservation.

The DeConcini reservation was accepted by President Carter, during tense negotiations, to win the two-thirds approval of the first Panama treaty in the Senate. The first treaty concerns preservation of the canal's neutrality; the second, now under consideration, spells out conditions for U.S. transfer of the canal to Panama between now and 2000.

Several liberal Democratic senators who support the treaties argued strongly against the DeConcini reservation as unwarranted and provocative. Administration officials decided they had to accept it to win over Sen. DeConcini and several other senators.

## Vance Tells House Panel

## U.S. Is Assured by Turks Over Military Operations

BY Oswald Johnston

WASHINGTON, April 7—The Carter administration has been assured that Turkey will allow the United States to resume military and intelligence operations from about a dozen major U.S. and NATO bases closed three years ago if Congress lifts the arms embargo against Turkey, Secretary of State Cyrus Vance said yesterday.

Opening an administration campaign to convince Congress that the embargo has outlived its usefulness, Mr. Vance, accompanied by Defense Secretary Harold Brown, also told a congressional committee that he expects a serious negotiating attempt to solve the impasse between the Greek and Turkish communities on Cyprus within the next two weeks.

The embargo was imposed in early 1975 to rebuke Turkey for using U.S. weapons when it invaded Cyprus in July and August,

1974. Attempts by the Ford administration to lift the embargo failed, in part because of pressure from Greek-American voters and politicians.

## More Receptive

Mr. Vance and Mr. Brown found the House International Relations Committee yesterday considerably more receptive to their arguments than they had expected, despite the presence of Rep. Benjamin Rosenthal, D-N.Y., an architect of the original embargo, and Rep. Gus Yatron, D-Pa., a strong supporter of the embargo.

Mr. Vance stressed that easing the embargo would make a Cypriot settlement more likely because it would remove political pressure under which successive Turkish governments have refused to negotiate.

He said that the new government of Premier Bulent Ecevit appeared strong enough and stable enough to compromise on a Cypriot settlement. He also said that a detailed proposal for a constitutional and territorial compromise is expected in about 10 days.

Mr. Brown said that the closing of NATO bases and U.S. intelligence installations had seriously weakened the alliance and damaged the ability of the United States to monitor Soviet strategic missile launch tests.

## Reopening Possible

Mr. Vance disclosed that the Turks have agreed to reopen the bases when the embargo is lifted. He also held out hope of the more important installations being activated immediately while a new agreement on their use is worked out.

The closed U.S. intelligence bases include Diyarbakir and Firincik, two radar installations in southeast Turkey, and Belbas, a seismic detection base near Ankara that monitored underground nuclear explosions. Also considered critical are Karamursel, a ship-monitoring facility near the Turkish straits, and a similar installation at Sinop, on the south coast of the Black Sea.

Mr. Vance noted that the Cyprus negotiations, at a standstill for the last year, are due to be reopened later this month when the Turkish-Cypriot community presents its constitutional and territorial proposals to United Nations Secretary-General Kurt Waldheim. If Mr. Waldheim agrees, talks with the Greek-Cypriot community could be resumed.

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## Kremlin Sees Dangerous Trend In Popularity of 'Crucifix' Jewelry

MOSCOW, April 7—"I have a cross," the middle-aged Moscow woman whispered, pulling a hillfold out of her purse. "Here, I'll show it to you." She glanced around to make sure that no one else could see, then extracted a tiny blue-and-silver crucifix.

"I don't wear it so I don't give people something to gossip about," she said. Crosses and crucifixes are officially taboo here, where the Russian Orthodox Church once reigned along with the czars, and the cross stood next to the two-headed eagle as a symbol of Russia. But crosses are not even sold in the jewelry stores today, although the few functioning churches still sell them.

Now young people have taken to wearing crosses as jewelry in what the government considers to be a dangerous fad.

Science and Religion, a state magazine, said recently, "A responsible Soviet citizen would never wear the cross as a piece of jewelry."

The Moscow woman is typical of what the state apparently considers a dangerous, borderline case. She describes herself as an atheist. Why does she carry the tiny cross then? "It's a tradition," she said. "I'm not a believer, but I am a real Russian. I like to go into a church now and then, too. Many people who are not believers do. They go sometimes when things aren't going well, or when their parents are sick."

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## WHERE THE WORLD MEETS

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## 9. Homesick.

(Another good reason to call home.)

An international call is the next best thing to being there.

هذا من الأصل



## Two Receivers Malfunction

## U.S. Scientists Perplexed By Voyager 2's Problems

By George Alexander

PASADENA, Calif., April 7—Just as they were beginning to overcome the problems that had cropped up on Voyager 1, scientists at the Jet Propulsion Laboratory here yesterday were confronted with serious problems on the Voyager 2 spacecraft.

Both Voyagers are bound for the planets Jupiter and Saturn and are due to arrive at Jupiter sometime next year.

The problems with Voyager 2 are in the probe's radio receivers. Flight controllers here noticed that one of two identical receivers aboard Voyager 2 was acting up.

They radioed a command to the unmanned probe, about 280 million miles from earth, to switch over to the second receiver. It did so and everything went smoothly for about 14 minutes.

## Erratic Action

But then the second receiver began performing erratically, and controllers commanded the probe's communications system to switch back to the first receiver. "It went out on us almost immediately after the switch-over," an official said.

Because the probe is tuned to the first receiver, there is no way that controllers here can signal the dead unit to instruct it to switch again to the second receiver.

However, the Voyager's on-board computer will switch automatically from one receiver to the other if it does not log any instructions from the controllers for seven days. This automatic switch was built into the Voyager's computer in case of problems with the probe's communications systems.

It is not yet known whether the first receiver aboard Voyager 2 is permanently off the air. "Receivers usually don't cause you any trouble," said the laboratory official. "They're probably the least troublesome equipment on any spacecraft today. But here we've got problems with two."

The fact that the second receiver also has been acting erratically has given an urgency to the problem. "Everybody has been pulled off [Voyager] number one," he added, "and put to work on number two."

© Los Angeles Times

## House Supports Repoliticizing of U.S. Post Office

WASHINGTON, April 7 (WP)—The House passed legislation yesterday that would return to the President and Congress some of the power over the U.S. Postal Service they relinquished seven years ago.

The bill, passed 384 to 11, would turn the postmaster general back into a presidential appointee, give Congress a veto over policy changes such as the proposed cancellation of Saturday deliveries and remove the current ceiling of \$980 million a year on the postal subsidy. It would require the Postal Service to explain in detail to Congress each year how it plans to spend its money.

## Bowling Balls Burned

OLATHE, Kan., April 7 (UPI)—The fire department here discovered two burning bowling balls behind a residential garage. Officials theorized that a disgruntled bowler, who had sworn off the sport, had elected to burn the balls.

## FBI Questions Interest of Congressman

## Ford Action on Hospital Funds Probed

By George Lardner Jr.

WASHINGTON, April 7 (WP)—The FBI is investigating a sudden turnaround by the Ford administration in 1975 that resulted in the release of U.S. funds for Philadelphia's Hahnemann Hospital.

According to a government study of the \$145 million grant, the administration at first decided to hold up the money under the Impoundment Control Act of 1974, but then hurriedly reversed itself under pressure from Rep. Daniel Flood, D-Pa. The flip-flop came on the day before President Ford's deferral announcement was to be sent to Capitol Hill.

Mr. Flood, who pushed the Hahnemann appropriation through Congress, and Rep. Joshua Eilberg, D-Pa., whose law firm was hired at about the same time to secure additional financing, have come under investigation in connection with allegations that they might have profited from the hospital's \$63.5 million construction program.

## Irregularities Found

All bank records pertaining to Mr. Flood's and Mr. Eilberg's accounts in the House were recently subpoenaed by a U.S. grand jury in Philadelphia.

A separate inquiry into the circumstances of the funding was conducted in February by the Community Service Administration, which Congress assigned to pay the Hahnemann money. A

nine-page report compiled by CSA general counsel Frank Jones singled out a number of irregularities in the course of the still uncompleted project, including the improper expenditure of about \$472,400.

Released under the Freedom of Information Act, the report also

stated that the CSA, as the government's anti-poverty agency, had been reluctant at the outset to spend the unsought appropriation. As a consequence, the memo stated, in June, 1975, CSA originated and, with the help of an official at the White House Office of Management and Budget, arranged a deferral of the money to take effect June 24, 1975.

## Congress Has Last Word

But under the Impoundment Control Act, such intended deferrals must be communicated to Congress, either chamber of which can then overturn them and direct that the money be spent.

President Ford had signed a message stating that the money was being held up to determine "what legal authority" CSA had for hospital construction activity.

Citing an OMB official, the report then said: "Congressman Flood's office and Flood himself brought pressure on the White House to reverse itself before the message ever got to Capitol Hill."



## New General

Col. Margaret Brewer, 47, was nominated by President Carter for one-star brigadier rank. If approved by the Senate, the 26-year veteran would be the first woman general in the history of the U.S. Marines.

## House Unit Bids For Korea Plan

WASHINGTON, April 7 (WP)—A House Armed Services Subcommittee approved a plan yesterday to make possible the scheduled pullout of 6,000 U.S. troops from South Korea this year.

However, the plan sponsored by subcommittee Chairman Samuel Stratton, D-N.Y., would require a "basic ground combat force" of U.S. troops to remain until a political settlement is achieved between North and

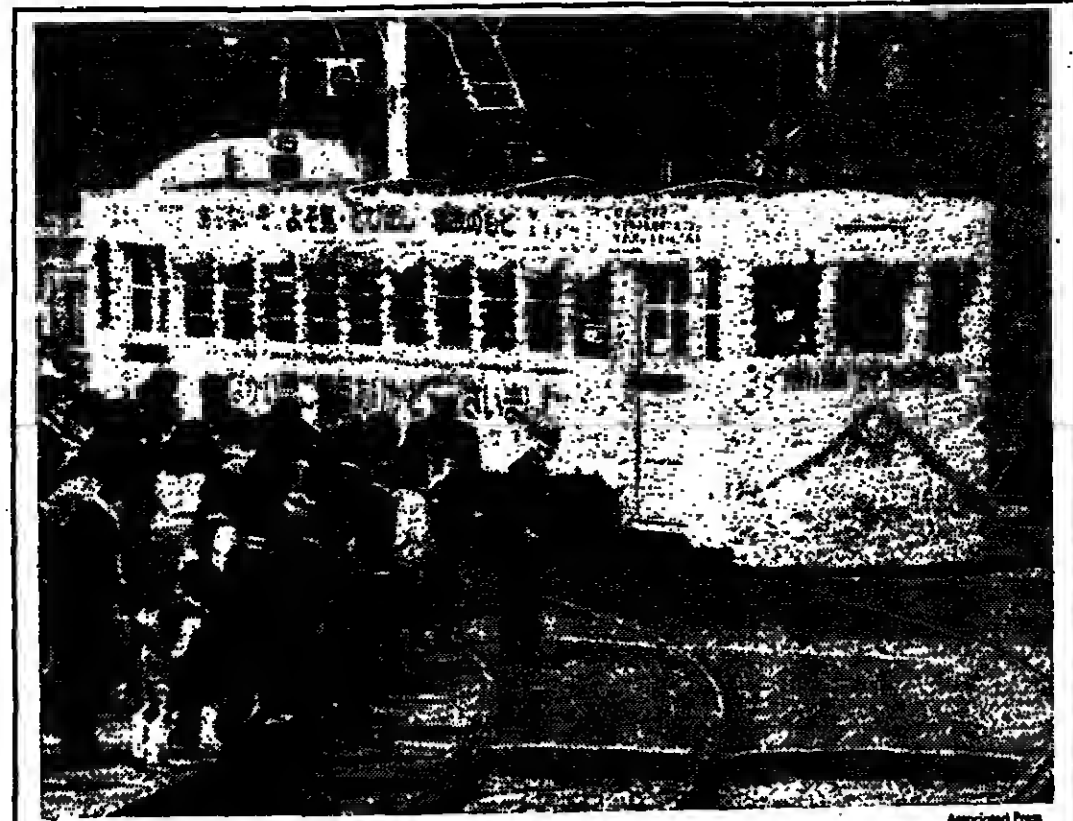
South Korea. Such a settlement is not in sight and is considered unlikely.

The Stratton plan, adopted 7 to 1, against the dissenting vote of Rep. Ronald Dellums, D-Calif., represents a middle course between opposing views in Washington about the immediate future of President Carter's troop-withdrawal plan. One proposal would allow the gradual withdrawal of troops over five years and the other would postpone action for 12 months.

## Grounded Tanker Is Freed in U.S.

NEW ORLEANS, April 7 (AP)—A U.S. tanker loaded with Alaskan crude oil has freed itself from a mud bank at the mouth of the Mississippi River and proceeded upriver.

A Coast Guard spokesman said that the 220-meter Mount Washington pumped its oil to the side which was afloat, lifting the other side from the mud. He added that there was no oil leak.



THAT'S THE GOOD NEWS—A streetcar covered with flowers moves along Tokyo's last streetcar line to announce that the crews serving the trolleys will be cut by half—from two to one—as a step toward doing away with the entire decades-old system in the near future.

## In Deaths of 3 Oklahoma Girls

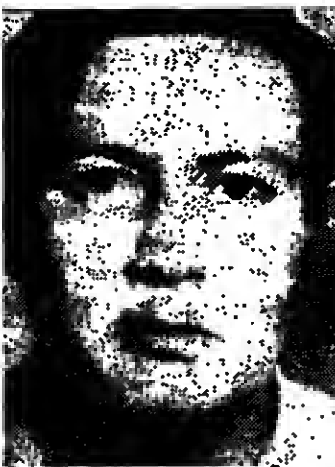
## Man Sought in U.S. Slayings Captured

McALESTER, Okla., April 7 (AP)—Eight lawmen kicked down the door of a cabin in the scrubby hills of eastern Oklahoma yesterday and, after a brief scuffle, arrested Gene Leroy Hart, 34, the fugitive sought in the slayings of three Girl Scouts at a summer camp last year.

District Attorney Sid Wise said that Hart would be arraigned today. He was taken to the state prison here last night.

He was captured by agents of the Oklahoma State Bureau of Investigation in the isolated cabin in the Cookson Hills, ending what was believed to be the longest manhunt in Oklahoma history.

Dick Wilkerson, bureau deputy director, said that the agency had learned that there was "someone



Gene Leroy Hart

living with an old man who lived by himself in a rural area and who cut wood and received some type of check."

The check was determined to be a Social Security check, and Mr. Wilkerson said it was believed that Hart had been living in the house since November.

Charges of harboring a fugitive would be made against the owner of the house, Sam Pigeon Jr., Mr. Wilkerson said.

## 3 Counts of Murder

Hart was charged with three counts of first-degree murder on June 23, 1977, 10 days after counselors at Camp Scout near Locust Grove, Okla., found the bodies of the three girls.

Doris Denise Milner, 10, and Lori Lee Farmer, 8, both of Tul-

## Carter Promises To Veto Costly Farmer Aid Bill

WASHINGTON, April 7 (WP)—President Carter yesterday told Congress that he would veto the multibillion-dollar emergency farm bill "should that legislation reach my desk."

In a letter to Sen. Edmund Muskie, D-Maine, chairman of the Senate Budget Committee and one of the leading opponents of the farm measure, the President characterized the legislation as being "hastily drafted in an atmosphere of emotion and confusion."

He said that measures to boost farm income that were proposed last week by the White House would be sufficient to aid the agricultural community.

The House Budget Committee earlier refused to recommend an increase in next year's budget to cover the higher costs of the farm bill, which would raise support prices for the coming season in proportion to the amount of acreage taken out of production.

## Monkey Beater Beaten

LONDON, April 7 (UPI)—A zoo keeper who was fired for allegedly attacking a monkey with a stick has been refused compensation for what he charged was "unfair dismissal." An industrial tribunal did not believe that the keeper had struck the monkey in self-defense because it had taken "an aggressive stance."

sa, and Michelle Guse, 9, of Broken Arrow, were found near their tent on June 13. Investigators said that two of the girls were apparently bludgeoned to death and the other strangled. All had been sexually molested.

Hart had been a fugitive since his September, 1973, escape from the Mayes County jail in Pryor, Okla., where he had been awaiting transfer to the state prison to begin serving a rape sentence.

Authorities linked him to the slayings after finding two tattered photographs near the camp. Hart is believed to have printed the photos, taken at a 1968 wedding in southwestern Oklahoma, in a prison darkroom after serving as a photographer's assistant at the ceremony.

Law officials said that his capture followed months of exhaustive investigation. "You don't look into anything in the Cookson Hills," Mr. Wilkerson said. "You make your own luck by going out and kicking the brush."

## Fears Russians Will Overtake U.S. Fleet

## Navy Chief Attacks Carter Ship Curb

By Norman Kempster

WASHINGTON, April 7—The United States is in danger of losing its superiority over the Soviet Navy during the 1980s at the present pace of combat ship construction, Adm. James Holloway 3d, the chief of naval operations, said today.

The five-year shipbuilding program President Carter sent to Congress last month is not adequate to maintain this country's superior strength at sea unless the program is increased substantially in future years, according to Adm. Holloway.

Adm. Holloway, who retires in June, and Navy Secretary Graham Claytor Jr. avoided outright opposition to the President by telling the House Armed Services subcommittee on seapower that the Navy could live with Mr. Carter's program for a year or two.

"The five-year plan that has been presented to the Congress will permit this country to maintain the current thin level of superiority in maritime forces for about 10 years," Adm. Holloway said.

## 14 Ships a Year

Mr. Carter's program calls for building an average of 14 ships a year for the next five years. It would provide for construction of one diesel-powered aircraft carrier in 1980 but no nuclear-powered carrier during the five years.

Defense Secretary Harold Brown recommended the 14-ship-a-year program after determining that the Pentagon could do no more within its \$126-billion budget for fiscal 1979.

Mr. Claytor said that the Navy could not transfer money from other parts of its budget to shipbuilding. But he invited the

## Stronger Air Defenses Urged

## Brown Warns Carter on Russia

By Bernard Weinraub

WASHINGTON, April 7 (NYT)—Secretary of Defense Harold Brown has told President Carter that the deployment of a Soviet bomber "has changed the character of the possible threat" from the Soviet Union and that stronger air defenses are needed in the United States.

Mr. Brown, in a 10-page secret memorandum to the President, also said that the Defense Department believed that Israel was capable of winning a war in the Middle East, "at least through 1983."

"While Arab inventories of military equipment are expected to remain considerably larger than those of Israel," Mr. Brown wrote, "the ratio is improving for the Israelis, and we would expect them to prevail in any war at least through 1983."

The defense secretary's memorandum, to President Carter, which was sent in the last two weeks, candidly discusses a wide range of defense and international issues, including problems with the Atlantic alliance and growing Soviet capabilities. The document, stamped secret, was obtained yesterday by The New York Times.

## Worry Expressed

In the document, Mr. Brown expressed his worry about the new supersonic Soviet bomber, which has been code-named Backfire in the West, capable of reaching U.S. targets.

"Our policy in recent years has been not to invest heavily in continental air defense on grounds that it makes little sense in an era when we are defenseless against ICBMs and SLBMs," Mr. Brown said, referring to intercontinental ballistic missiles and submarine-launched ballistic missiles.

"However, we have maintained a modest force dedicated to air defense," Mr. Brown said. "That policy has been likened to a 'Coast Guard of the Air'—the intention being to prevent overflight provocations and 'free rides' without really aspiring to substantially reduce U.S. casualties in an all-out attack."

"The advent of the Soviet Backfire has changed the character of the possible threat," Mr. Brown added.

The defense secretary indicated

that as a first step in countering that threat, he was directing that 72 F-15 fighters from the Tactical Air Command "be made available for a crisis."

## Civil Defense

Mr. Brown also urged the President to support an increase in the nation's "small and static civil-defense program." He urged an annual increase of \$50 million a year, at least until 1984, for the civil-defense budget, which now runs at about \$100 million a year.

"As you know," Mr. Brown said, "the Soviets have shown great interest and considerable activity in this field [civil defense]. While I do not believe that the effort significantly enhances the prospects for Soviet society as a whole following any full-scale nuclear exchange, it has obviously had an effect on international perceptions, particularly in contrast to our small and static civil defense program. For that reason alone, I believe at least modest efforts on our part could have a high payoff."

Discussing the North Atlantic Treaty Organization, Mr. Brown told the President he was tentatively undertaking "an ambitious program" to store as much combat equipment and supplies as possible in Western Europe because Warsaw Pact forces could be mobilized so quickly that the United States would not have enough time to send adequate combat supplies.

"This is a serious plan, and one of the key elements in improving our contribution to the alliance," Mr. Brown said. "Consequently, I have diverted funds from the Navy and the Air Force to the Army to pay for this pre-positioning."

## Budgetary Problems

Budgetary problems were discussed in some detail in the document, which is a summary of planning guidance given to the armed forces recently by the secretary and his staff.

Mr. Brown also indicated that he was perplexed by the Navy's problems and made it plain that it was probably up to the President to resolve some of them.

The basic problem, the defense secretary said, was that the cost of ships and planes for the Navy was rising faster than the defense budget and the Navy's share of it.

As an example, he said that three ships that were being considered for the 1980 fiscal year building program—a Trident submarine, a nuclear-powered cruiser and a medium-sized conventional carrier—would alone cost almost \$4 billion, not much less than the entire 1979 program.

"The situation faces us with something of a dilemma," he said. "On the one hand, we could decide to do the best we can at the current level of funding. The full effects would manifest themselves only a decade or more from now. On the other hand, we could fund the Navy at a higher level—perhaps \$3 billion—today. If that were done within the current budget by transferring funds from the other services, I have no doubt it would jeopardize our efforts to improve our capability in the central front of NATO."

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## Goading Israel

For 26 years Israel has acquired arms under a formal agreement with the United States. On occasions too numerous to recite it has used those weapons outside as well as inside its own borders. Through three major wars and countless incidents, successive administrations have understood that the realities of Arab hostility justified the reading that, in using U.S. weapons in that way, Israel was acting in legitimate self-defense. Why, then, did Secretary of State Cyrus Vance feel bound to slap Israel hard on Wednesday by informing Congress that Israel "may" have violated the 1952 military aid agreement in its recent intervention in Lebanon?

Mr. Vance offered no explanation. He merely made the charge and indicated Washington would not invoke the arms cutoff that a 1976 law requires if a "substantial violation" of a military-supply agreement is found. But that is unsatisfactory. What are the standards the State Department applies in this case and in general? All arms recipients are entitled to know. Is it conceivable that "legitimate self-defense," the 1952 language, does not cover a country that has lost more than 1,000 lives to terrorists crossing from a neighboring state—Lebanon—that does not perform the elementary national

duty of policing its own territory? A country that, even as the rebuke arrives, is withdrawing its forces under the terms of a UN resolution drafted in the first instance by the United States? We don't understand.

We support the administration's strategy of seeking a Mideast peace agreement. But some of its tactics are insensitive. Right now, for instance, the administration should be concentrating on persuading Israel to rethink parts of its position in the negotiations with Egypt.

It can only weaken the U.S. case if, while presenting it, the United States acts in other ways to embarrass Israel and nourish its swollen suspicions that its security is of fading U.S. concern. It is one thing to criticize the Lebanese operation, as we have done, for its heavy civilian toll. It is another to smear Israel with a vague allegation that puts a cloud over access to the arms on which its security depends. As a good lawyer, Mr. Vance could have found a half-dozen other ways to handle the congressional inquiries on Israel's use of U.S. arms in Lebanon. Instead, a calculated decision seems to have been made to use the issue as a gratuitous political goad.

THE WASHINGTON POST.

## Succumbing in Nigeria

Frankly, we liked the administration's Rhodesia-Zimbabwe policy better before the President dropped in on Nigeria. A month ago, for instance, soon after Ian Smith agreed to turn over power to an elected majority-rule government later this year, the administration was still complaining that he had not opened the door to the guerrillas sworn to destroy him. But there was, too, some recognition that the agreement between Mr. Smith and "internal" black nationalists reflected "some progress...a step in the right direction"—as, of course, it did.

In Lagos, however, Mr. Carter seems to have succumbed to Nigeria's uncomplicated fervor for a Popular Front guerrilla victory. The final communiqué omitted any mention of progress in Salisbury, although a multilateral interim government actually exists there. Rather, the communiqué (signed for Nigeria by its unelected military leader) pronounced the internal procedure "unacceptable, as it does not guarantee a genuine transfer of power to the majority"—as though the guerrillas, who have refused to settle for the share of power they might expect to win in elections, will consummate "a genuine transfer of power to the majority" if they win by force of arms.

We understand that the administration seeks to draw internal and external forces together, the better to bring peace to Zimbabwe, preempt Cuban-Soviet intervention and show South Africa that peaceable change works passably well. Those are wor-

thy purposes. But Mr. Carter's pursuit of these purposes can be painful. Virtually all his rhetoric favors the external people. He holds Salisbury to lofty moral and political standards, while often appearing to wink at the failings of the Popular Front. He refuses to say the one thing that might most clear the air: that if the guerrillas reject a fair opportunity to come home while Salisbury moves to honest majority rule, the United States will go with Salisbury. His performance is all the more baffling when you consider that the internal settlement looks to be more democratic, moderate and multiracial than any government the guerrillas might construct.

Does the United States gain respect for itself and a bearing for its policies—among internal or external Rhodesians, in Nigeria or elsewhere in Africa—by conveying an impression that it will do practically anything to win liberationist credentials? We doubt it and we think the President doubts it too. Indeed, in Lagos he conspicuously did not do the easy, popular-in-Africa thing with respect to South Africa, choosing instead to affirm the United States' own, less militant policy. His hosts did not like it and said so. But on their part, they withheld any real support for the American effort to limit Soviet-Cuban intervention in Africa. Such candor—and continued discussion—is what good friends, especially those trying to become better friends, owe each other. It should be applied to Rhodesia, too.

THE WASHINGTON POST.

### Other U.S. Opinion

#### FBI and Terrorists

Most persons in the United States will praise, rather than criticize the decision of the FBI to give agents special training to deal with terrorist hijackings or kidnappings.

FBI Director William Webster disclosed the program in his first news conference. He said Europe's terrible experience—West Germany, the Netherlands and Italy in particular—convinced the agency it ought to be prepared for the possibility this kind of activity might spill over here.

European experts have been brought to the FBI training academy in Quantico, Va., to bolster the training program. The agency also is developing sophisticated "profiles" on potential terrorists and is working close with the Army's anti-terrorist program.

Now that Webster has reassured us, his public conversation on this subject should stop. Talking about the possibility of terrorism might be the cause of it. Some "crazy" somewhere might get it into his head to challenge the new program.

—From the Detroit News.

#### Problem of Bhutto

Pakistan's military junta headed by Gen. Zia may think it solved a primary problem the other day when a Pakistani court found former Prime Minister Zulfikar Ali Bhutto

guilty of conspiracy to murder and sentenced him to hang. The charismatic Bhutto, still the giant on the Pakistani political scene, has been a burden to Zia since the military overthrew Bhutto's elected government last year.

But Zia should think twice before the noose is slipped around Bhutto's neck. The former prime minister did not run a first-class democracy. There is reason to believe that he rigged the nation's last election. And he may very well be guilty of conspiring to kill a political opponent. However, there are three serious problems with Bhutto's trial, casting doubt on the legitimacy of the verdict.

First, the prosecutor's case was presented in public, but Bhutto's defense was made behind closed doors. Thus only one side of the case has been heard openly. Second, Zia himself let it be known what he thought the verdict should be before the trial. Third, the chief judge made it clear that he had no love for Bhutto....

Zia's government needs respectability, both at home and abroad. The general is not likely to achieve that, given the befouled atmosphere surrounding Bhutto's trial. Zia should seriously consider some form of clemency. Otherwise many observers will wonder if he is indulging in officially sanctioned political murder—the very crime of which Bhutto supposedly is guilty.

—From the Milwaukee Journal.

### International Opinion

#### France Should Negotiate

Europe is now in conflict with the tougher new U.S. policy on uranium supplies which is designed to prevent the spread of nuclear weapons to countries which do not possess them. To be more precise, France is in conflict: but a decision to negotiate with the United States is one for the [European Economic Community] Community in which France has a veto. The Americans...have given notice that

they want to renegotiate parts of the treaty with the Community under which they supply enriched uranium for European power stations. They want about 30 changes in all, but especially they want the power to forbid reprocessing of nuclear fuel originating in the United States and the transfer of fuel to third countries. France, which is expanding its own enrichment plant, insists that a treaty is a treaty....

—From the Guardian (London).

### In the International Edition

#### Seventy-Five Years Ago

April 8, 1903

PARIS—A glance at the Herald's front page this morning will satisfy the most rabid opponent of monarchical government that kings and emperors have an exceedingly hard-working time. The day of the "lazy king" is past. His Britannic Majesty, the Serbian King and the German Kaiser all had very busy days, whether it was regulating questions at home or abroad.

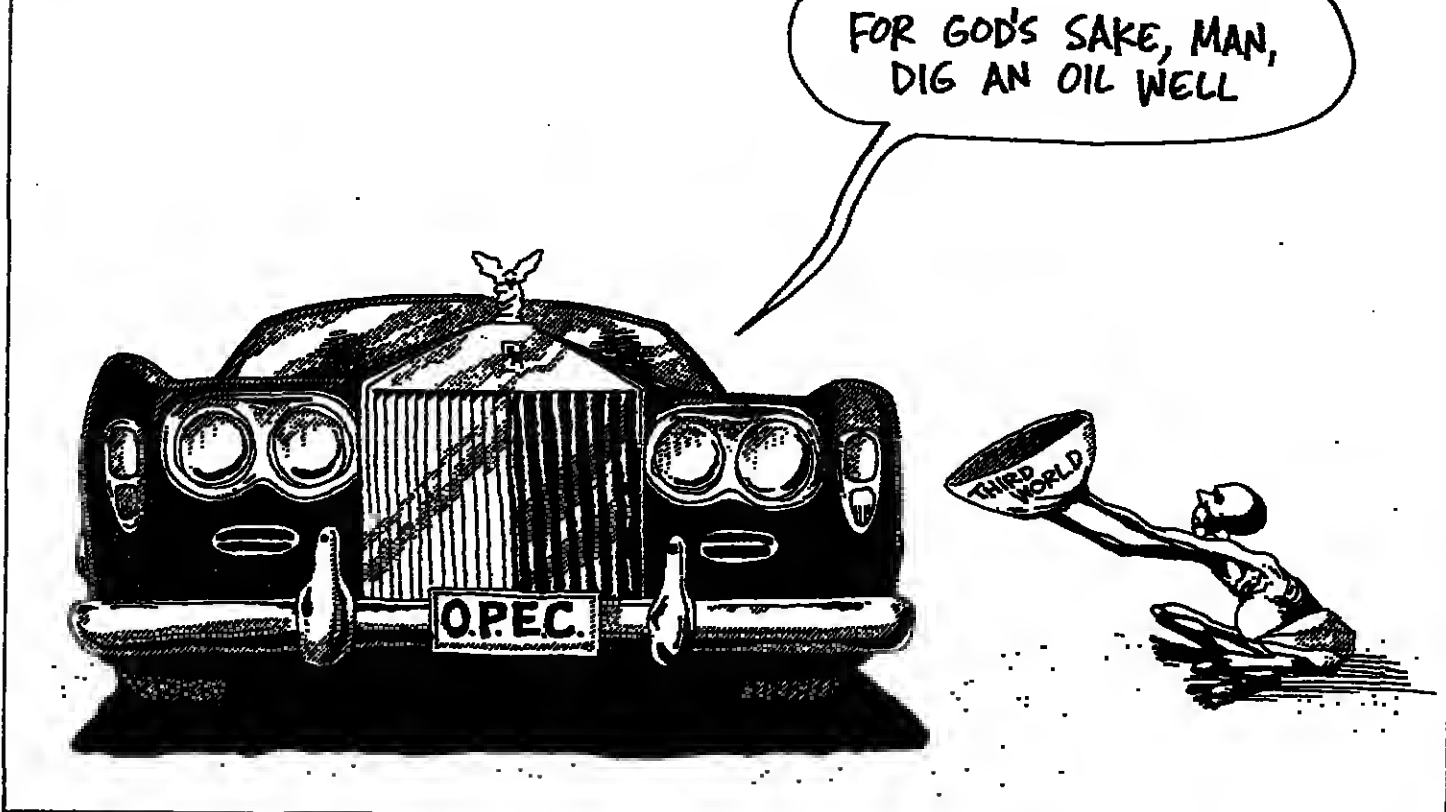
#### Fifty Years Ago

April 8, 1928

NEW YORK—Predicting that "the world is on its way in fraternity and cannot miss its goal," Dr. S. Parkes Cadman, president of the Federal Council of Churches of Christ in America, in an address recently at the Bedford branch of the YMCA, Brooklyn, spoke of an in his social relationships and reviewed the progress in recent years towards world brotherhood.

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## Why Carter Hesitates on the Neutron Bomb

By James Reston

WASHINGTON—President Carter has been criticized here recently for "hesitating" to order the production of neutron artillery weapons. Even some members of his own White House staff and Cabinet have wondered why he seems so troubled about giving the order to go ahead.

Why shouldn't he be "troubled" and "hesitant" when he considers where this alarming competition will end? A half-starved world is already spending over \$350 billion a year on weaponry, and if Jimmy Carter is committed to anything—politically and philosophically—it is to try to get this arms race by the throat.

So after hearing all the arguments for and against these bandy little atomic weapons, he pauses, and temporizes, and thinks about compromising. And a good thing, too. If the Russians go ahead with every devilish new device their science and imagination can conceive—and they just about have—and we do the same to match them, and then they raise the ante to match us and so on, who will break the ring? And how will the nations ever progress toward a safer and more rational world?

### Fuss

As I understand all the fuss over whether Carter decided against the neutron weapons and then pulled back under pressure from his colleagues and allies, it is this philosophic question that has held him up.

Besides, what's the rush? A good argument can be made on military terms for producing neutron shells—they are tank-killers that would minimize and maybe even neutralize an attack by the excessive Communist forces in Eastern Europe.

A counterargument can also be made, again on military terms, for not introducing them into the arsenal of the Western alliance on the ground that, if used against a Communist invasion, they might lead to an uncontrollable nuclear world war. But in political and philosophical terms, it is hard to argue with caution and delay.

The West Germans still have their doubts about the wisdom of deploying these weapons years from now on their soil. They want the Dutch and the Belgians to approve such deployment, though it is not clear that the neutron weapons now on the drawing boards could be used effectively with a range of less than 10 miles except from West Germany.

### Vance's Trip

Also, Secretary of State Cyrus Vance is going to Moscow at the end of this month to renew the delicate negotiations for a second Strategic Arms Limitation Treaty. So why decide the issue one way or another before he gets there?

Carter was not confronted by an either-or decision to produce or not produce these weapons. There are many different stages in production of neutron weapons, with or without their neutron

warheads. And many options on how and where and when they might be deployed after they were produced years from now. So it is possible for him to compromise without banning the neutron weapons or rushing ahead with them. He could keep the neutron option open without rushing into it before Vance got to Moscow or the Allies had made up their minds.

For the big question is not what is to be done about this particular weapon, but what is to be done about the whole reckless and expensive process of the world arms race. And here Carter no doubt differs with some of his advisers.

### Moral Issue

For him, the ever-expanding development of weapons is not only a military and political but a moral question. He is more willing than his colleagues in the Defense Department to take risks

for peace, even if he has to hold up the development of some new weapons in order to demonstrate his good faith and encourage the Soviets to do the same. In his view, as I understand it, he can indicate his opposition to producing whatever new atomic weapon comes along, and then, if the Russians insist on going ahead with all their own weapons, he can always, if reluctantly, go ahead with whatever new weapons he chooses.

Also, there are some political maneuvers going on in all this. Carter has recently made a very tough speech about U.S.-Soviet relations. He made clear at Winston-Salem, N.C., last month that Moscow could have a second strategic arms treaty, but not if they continued to use their conventional weapons and their Cuban mercenaries to change the political map of Africa.

Having done so, he also wanted

to indicate that if there were a genuine reduction of tensions, the question of producing U.S. neutron weapons could be discussed. At the same time, he wanted the West Germans to know that the neutron question was an Allied, and not solely a U.S. decision. If West Germany wouldn't deploy it, there wasn't much point in Washington's producing it.

There is a great deal to be said about this neutron issue on all sides, but maybe it is not quite as urgent as it seems. There is a long lead-time in producing these weapons, and it will be longer still before they are put in place, if they ever are. Meanwhile, Carter has a lot to discuss with Soviet leader Brezhnev after the Vance mission to Moscow about the larger question of the arms race and the political rivalries in the Middle East and Africa. And this also looms in Carter's mind, larger than the present dispute over this one important weapon.

## China Rights Issue: Hands Off

By Robert W. Barnett

WASHINGTON—The nation is putting before itself a practical question: Should we make Peking's record in handling what Americans call the "human rights" of the Chinese people an obstacle to normalizing diplomatic relations between the United States and the People's Republic of China?

We should not. I go further. We should want to seek better understanding of the moral content in how and why Peking has sustained the legitimacy of its authority through means alien to the political experience of the Western world.

The psychic and philosophical premises upon which the Chinese system operates differ from those of other countries, whether or not Marxist, affluent or developing. But we should hesitate to condemn them as less moral merely because they are different from those of other societies. In fact, China could be giving clues to perception of moral necessities that we may be obliged to recognize if we begin to believe that we cannot assume our economic and social satisfactions merely by perpetual opening up of new resource frontiers, geographical and technological.

### Chiang's Role

After World War II, Chiang Kai-shek was supported by friends at home and abroad in an effort to restore pride and effectiveness to a Chinese system crippled and demoralized by 150 years of humiliation and catastrophe. But the tragic fallacy in Chiang's leadership was that its legitimacy and moral sanction had stronger roots abroad than within his own Chinese environment.

The People's Republic of China won its civil war because its authority was based upon strictly Chinese resources; its leaders

achieved total national self-reliance through mobilization of the moral support of a population committed to egalitarianism in the way it looked, it talks and behaves. Visitors from many other parts of the developing world, awed by that achievement, can identify administrative mechanics, but cannot imagine infusing their own people with the moral devotion upon which the Chinese system appears to be built.

Harsh national necessity shapes China's assessment of "human rights." The first right is to survive. With China's population of 900 million to 950 million growing at a thundering rate of 15 million to 20 million year after year, the challenge to China's survival has been pervasive, sustained and profound.

China's responses, both voluntary and directed from Peking, reverse the stress in the freedom-and-duty matrix upon which Western democratic traditions are built. But in Korea, Vietnam, Taiwan, Hong Kong, Japan and in China there seems to be utter natural acceptance of the age-old Confucian tradition of subordinating individual liberty to collective obligation—for example, to the family. So here may be the clue to what—deep in the imagination of Chinese everywhere—is their moral equivalent to the individual human rights that Americans believe are sanctified by the Holy Bible, the Declaration of Independence, and the Bill of Rights in our Constitution.

From the days when China's leaders lived in Yenan caves to the establishment of national authority in Peking, through the Great Leap Forward, through the Cultural Revolution, through the arrest of the Gang of Four, and the re-emergence of the twice-humiliated first Deputy Prime Minister Teng Hsiao-ping, there has

been a remarkable continuity of Chinese commitment to self-reliance and egalitarianism—China's moral accommodation to the necessity of survival. China's unshakable of its women, the "barefoot doctor," the mass participatory harnessing of China's rampant rivers, and what Norman Macrae, deputy editor of The Economist, calls China's "present-day rural Keynesianism are expressions of that compulsion."

### Normal Ties

Washington and Peking will enter into normal diplomatic relations with each other because doing so serves the self-interest of both countries. Neither should entertain expectations that it can reform the other. We must respect China's right to be different, or, doing otherwise, expose ourselves to charges of self-righteousness, demagoguery, and possibly even of imperial intent.

China's now-emerging personalities, procedures and political vocabulary offer promise of greater readiness by China to deal more forthrightly with other countries around the world. With respect and curiosity, Washington should hasten toward establishing normal diplomatic relations with Peking so as to ease changes of ideas, persons and goods from which the two countries can mutually benefit together and in their relations with other countries of the world community.

Robert W. Barnett, director of the Washington Center of the Asia Society, was Deputy Assistant Secretary of State for East Asian Affairs from 1963 through 1970. This was adapted by The New York Times from an article to appear in Worldview magazine.

## New Style Communism Still Exists

By Joseph Kraft

PARIS—"Eurocommunism" was a word to conjure with when I visited Europe last year. Now, in the wake of the French elections, it is said to be a thing that never was.

In fact, Eurocommunism still exists. Only it has turned out to be far less than it was cracked up to be. At the root of all the confusion is an undoubted change in the Communist parties of Italy, France, Spain and Portugal. In one way or another, they have all been brought up to date—re-aged, as it were, for more prosperous, less ideological consumer societies.

Thus the Communist Party in all four countries regularly criticizes Moscow on certain human-rights issues. Even the French party, which is perhaps most in thrall to the Soviet Union, attacked the recent Soviet decision to withdraw citizenship from the great leftist Mstislav Rostropovich.

The second undoubted change is willingness to work with middle-class parties. The Italian Communists have carried this trend furthest in the move toward a "historic compromise" with the ruling Christian Democrats. But the parties in France, Spain and Portugal have also moved at times to work jointly with democratic political groups.

A third change is a move toward a less dictatorial party structure. In France, cell meetings are supposedly open to the public. In Spain, where the Communists are competing with a dynamic Socialist party, the party leader, Santiago Carrillo, is talking of genuine elections to party office. He at least implies jettisoning Lenin's insistence on control from the top, or "democratic centralism," much as Stalin has been cast aside as a guide on human rights.

A fourth change has been willingness to take into the party, in leadership posts, persons of non-proletarian origins. Many of the top figures in the Italian Communist party are aristocrats, among them Secretary General Enrico Berlinguer.

These changes go beyond mere cosmetics. They have an inner dynamism, and they make an incident for further changes over time. They promote evolution.

But so far the West European Communist parties have not been transformed. For one thing, they still seek a monopoly of power.

Thus the Italian party would like to enter into coalition with the Christian Democrats by the route of "historic compromise." Berlinguer and his men are fully confident they can outshine, and eventually crush, the old-fashioned and ailing Christian Democrats.

In marked contrast, the French Communist party spoiled the chances of a leftist victory in the recent legislative elections by advertising their support for nationalization on a grand scale and by their refusal to cooperate in defense matters with the United States and other NATO countries. This sabotage was committed because a leftist victory would have established the Socialists as the leading French party, thus compromising, perhaps fatally, the chances for an eventual Communist takeover.

Despite the show of openness, moreover, decisions are still taken in secret by the party bosses. It is now known that even at the height of their alliance, the French Communist leader, Georges Marchais, was denouncing the Socialist leader, Francois Mitterrand, at secret meetings of the Politburo.

Finally, the European Communist parties still work, and work hard, for the Soviet strategic interest. All of them oppose the major defense and international economic policies favored by Washington. All of them have backed Russia's allies in the Middle East and Africa—not to mention Cuba.

In sum, Eurocommunism is very much alive. But it is what it has always been: an updated version of communism pure and simple. It may have a broader appeal in Western Europe, but it remains a threat to the interests and values cherished by most Americans and most Europeans. So the right policy is to draw out for as long as possible the entry to power of any Communists in any West European country.

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PACHYDERMIC PLAY—Soccer players at a safari lodge in Kenya get in a bit of practice with friendly elephants who let the players bounce ball off their heads for a few goals.

### 'Escapees' Stalking Animals in City

## Roving Lions Are Not Pride of Nairobi

By John Damton

NAIROBI, April 7 (NYT)—It began late one night in December under a full moon.

Tony Church, owner of a safari company, was driving back to his home, a 130-acre horse ranch four miles from the Nairobi National Park. He was expecting trouble because there had been an attack the night before, so he had already stabled 19 horses and lighted the hurricane lamps outside. Only the old mare refused to go in, hovering near the stable door to be close to her weaned foal inside.

### S. Africa Ends Terrorist Trial; 6 Are Convicted

PRETORIA, April 7 (AP)—One of South Africa's longest terrorist trials has ended with the acquittal of six blacks and the conviction of six others on charges of conspiring to overthrow the government.

The 12 were charged with belonging to the banned African National Congress and plotting since 1962 against the government. They were also accused of receiving military training in Mozambique and the Soviet Union, sabotaging railroads and illegally possessing arms.

They were first detained 16 months ago and went on trial early last year. But the original judge died, and the trial had to be restarted in January.

The judge said yesterday that the state had proved beyond doubt the existence of a plot against the government. But he acquitted Paulina Tsiki, 21, Lele Jacob Motaung, 44, Simon Samuel Mohlanyane, 23, Martin Ramokgadi, 67, and Jacob Gankala Seatholo, 47.

### Rhodesia Says 28 Killed in Day's Clashes

SALISBURY, Rhodesia, April 7 (UPI)—Black nationalist guerrillas attacked a hotel in southwestern Rhodesia in a flurry of incidents that claimed 28 lives in the last 24 hours, the military command said today.

The command said that insurgents last night attacked the Gwaii River Hotel, the hub of a farming community in southwestern Rhodesia.

The latest incidents were reported on the eve of the arrival of a British-U.S. team assigned to promote an internationally recognized peace.

The team of John Graham, deputy under secretary of the British Foreign Office, and Stephen Low, U.S. ambassador to Zambia, is scheduled to arrive tomorrow night.

The two envoys will try to convince the Rhodesian government to accept a British-U.S. call to stage a new Rhodesia conference, attended by all parties to the dispute, including the guerrilla-backed Patriotic Front.

### Gutenberg Bible Nets \$2 Million

NEW YORK, April 7 (Reuters)—A Gutenberg Bible, one of the world's rarest books, fetched a record auction price of \$2 million here today.

The two-volume Bible was bought at Christie's auction house by New York bookseller Martin Breslauer, who said he bought it for an anonymous client.

Mr. Breslauer said: "I was determined to get it at almost any price." The previous record auction price for a printed book was \$360,000 for J.J. Audubon's "Birds of America," also sold at Christie's.

"I got back at midnight," Mr. Church related. "I jumped into my pickup to take a look around. There was a full moon. Deadly quiet. Theo I saw them. It was an amazing sight. About 100 yards from my front door there were these four magnificent lions. They were obviously bell-bent on making a kill."

Mr. Church, who had lost two colts to the lions the night before, telephoned the veterinary at the park headquarters. Then, rushing back to the stable from his house, he noticed that the old mare was gone. "She was lured into an ambush," he said. "It happened so fast. I went back to the lions and she was already half eaten. It was like a scene out of the game preserve—these four magnificent creatures on a kill and half a dozen byenas running around cackling, and you know how they stuff up their tails."

#### A Pride on the Loose

Nairobi is in the midst of a lion scare. For three months a pride of lions has been "escaping" from the national park, a 44-square-mile preserve fenced in on three sides, whose main gate is only five miles from the city center. The lions have been prowling the suburbs of Langata and of Karen. The latter is named after Karen Blixen, the writer who published soaring evocations of East Africa—marauding lions included—under the name Isak Dinesen.

Initially the forays by the lionesses (females do the hunting) were regarded as something of a lark. "Girls will be girls," said an editorial in The Daily Nation in December, recalling that the Nairobi lions had engaged in pranks before, including a sit-in on the Mombasa road.

The predators have been shot with darts, drugged and returned to the park but still continue to evade a high fence to hunt for food in the residential areas, and now the jostling has given way to alarm. Editorials are calling the situation a scandal.

None of the lions has attacked a human being. But they have helped themselves to six horses, a cow and a dog. They have unsettled a number of residents, who discover their German shepherds quivering to come indoors at night and wake up the next morning to find claw marks on the stable doors and lion spoor across the driveway. Some are concerned about the long-term implications of having wild animals at the doorstep, considering that Nairobi, with a population of 800,000, is growing so rapidly that it is encroaching upon Baroness Blixen's beloved acacia-covered hills and the beasts that inhabit them.

Conservationists, ecologists and students of animal behavior agree that the lions, which are permanent residents of the park and number about 40, have been roaming because their primary sources of food, the zebra and the wildebeest, are in short supply.

#### Moving With the Rains

The herbivores migrate seasonally in and out of the park through the southern opening, moving across the adjoining Athi Kapiti Plains all the way to the Amboseli National Park and Tanzania. They leave the park during the rainy seasons, especially the "long rains" from March to June, and return during the dry spells, when the park offers the only drinking water.

This year, explained Samuel Ngethe, the chief warden of the park, the rains have been so plentiful that the zebra and antelope have not been compelled to return. He conceded, too, that the park grass had grown so high that it was shunned by the grazing animals, which like their grass short and sweet. "OK, they like short grass," he said. "People say we should be burning and mowing to draw them back. We have

done that in the past. But what happens if we burn it and we don't get more rain?"

#### Lion Spotting

For years the Nairobi preserve has been the biggest money-earner in the national park system, averaging 140,000 paying visitors annually. One reason is that it lies on the edge of the city; another is the high probability of spotting lions. "Wapi simba"—"Where is the lion?"—is a common Kiswahili greeting between parked motorists on a busy Sunday. Up to a dozen vehicles are apt to converge on a drowsy lion, waiting for it to rouse itself to make a kill, which is rare.

The Nairobi lions have more contact with lionizing humans—or at least with cars—than their cousins in other parts of Kenya. They also have a stronger lazy streak and prefer easy prey. "Our lions are not like the others," Mr. Ngethe explained. "They don't go for strong animals like buffalo. They go for the harebeest or the wildebeest. The wildebeest looks strong, but they're really very stupid."

This may be the only city in the world where it is possible to go to a drive-in movie on the edge of the game park and hear a resounding roar from the darkness in response to gunfire on the screen. Nowadays, however, few who live here have seen a lion at close range, except perhaps from a car, so it was little consolation when the minister of tourism and wildlife told them to fence their compounds to guard against the lions of Langata.

"If we secure all our livestock," said Mr. Church, alluding to his horse ranch, "these lions are going to get so damned hungry they'll feed on some drunken human being staggering back from a party."

### Medicare to Pay \$5,600 Tab For a Sex-Change Operation

SAN DIEGO, April 7 (UPI)—Federal officials said the Medicare program will pay for a \$5,600 sex-change operation for a man who has dressed and lived as a woman for three years. The operation will be performed on Bobbie Lea Bennett, 31, who is confined to a wheelchair by a rare bone disease.

Thomas Tierney, director of the U.S. Department of Health, Education and Welfare's Medicare bureau said a new policy extends Medicare coverage to sexual change, as long as the surgical candidates "have at least one year's experience living as a member of the opposite sex."

"From the information we have," he said, "it sounds as if Bobbie Lea Bennett would qualify for Medicare payment, and so the new policy amounts to a go-ahead for her surgery." Mr. Bennett, suffering from a disease that results in calcium-depleted bones, was married twice before he reached the age of 20. His first wife died in a car accident and his second marriage lasted only one day.

"By this time," he explained, "I knew I was really a woman." After three years of hormonal treatment and psychotherapy—which Medicare paid for—Mr. Bennett said he was told March 23 the program would not pick up the tab for the operation. But that was reversed by Mr. Tierney.

Upon hearing the news, Mr. Bennett said, "All I really want is to find Mr. Right, get married and be a housewife."

### CHURCH SERVICES

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Alma-Marceau. Sun. 63 at door 1  
Tel. 551-3830  
Edwin H. Tuller, Pastor.

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### Businessman Not Seriously Hurt

## Red Brigades Claim Shooting in Genoa

ROME, April 7 (UPI)—The Red Brigades, who claim the abduction of former Premier Aldo Moro, today took responsibility for the shooting of a Genoa businessman in the legs and right hand.

Police said that two men shot Felice Schiavetti, president of the Genoa Industrialists Association, in an ambush near his home, grabbed his attaché case and fled. Doctors said that his injuries were not serious.

"This is the Red Brigades," a telephone caller told the newspaper Corriere Mercantile soon afterwards. "We shot Schiavetti. A communique will follow."

In Rome, a series of bombings damaged the entrances of a police station, two Christian Democratic party offices and the headquarters of a Roman Catholic organization. And a policeman's parked car was set on fire. There were no injuries.

#### Ransom Demand Reported

Meanwhile, a neo-Fascist magazine said today that the terrorists are demanding \$1 billion in ransom for Mr. Moro's release.

Giorgio Pisanò, political editor of the rightist Italian Social Movement magazine Candido, said that he received a call from an anonymous informer saying that the Red Brigades "have begun undercover negotiations with the government to barter the life and liberty of Moro at a very high price."

The caller is quoted as saying that if \$1 billion is not paid at a time and place to be given later, then "the Red Brigades will publish everything they have got out of Moro, who knows the whole background of 30 years of government."

The Red Brigades kidnapped Mr. Moro on March 16, gunning down his five bodyguards. In one communique they said that they had put Mr. Moro on "trial" to discover the wrongdoings of the ruling Christian Democrats.

Mr. Moro's wife today wrote an open letter in a Milan newspaper, telling her husband that his family is living the ordeal with him "minute by minute."

Premier Giulio Andreotti, at least publicly, has rejected any negotiations with the Red Brigades, who have indicated that they want all of their imprisoned comrades—about 160 persons—released in exchange for Mr. Moro.

Mr. Moro, 61, president of the Christian Democratic party and a presidential hopeful, has beseeched his party to arrange a trade. But his letters were written in captivity and presumably under duress.

#### Top Aide Named by FBI

WASHINGTON, April 7 (UPI)—FBI Director William Webster yesterday announced the appointment of James Adams, 51, a career FBI man, as associate director of the agency.

The Italian government and the Vatican have denied that any secret talks are going on with the kidnappers.

Meanwhile, riot police had braced for trouble today after officials banned demonstrations that were planned to protest the arrests of leftists in the hunt for Mr. Moro's kidnappers.

More than 100 leftists were detained two days ago but at least 50 have since been released. The official Communist party newspaper L'Unita had said that the arrests were "indiscriminate" and other leftist newspapers had labeled them as a witchhunt.

### Obituaries

## Nicolas Nabokov, 75, Composer

NEW YORK, April 7 (NYT)—Nicolas Nabokov, 75, a composer and writer who organized three of the largest and most influential international music festivals in the neo-Communist world in the 1950s and 1960s, died early yesterday of a heart attack following an operation.

For several years, Mr. Nabokov—a cousin of the late novelist, Vladimir Nabokov—had been dividing his time between Paris and New York.

As a composer, Mr. Nabokov has been known chiefly for the last 13 years as composer of the score of "Don Quixote," a full-length ballet created by George Balanchine for the New York City Ballet in 1965.

He composed five ballets, the earliest of which was "Ode" for Serge Diaghilev's Ballets Russes in 1928. "Union Pacific," which he himself called "the first truly American ballet," was done for Col. De Basil's Ballets Russes and was introduced in Philadelphia in 1934. The libretto for "Union Pacific" was by Archibald MacLeish.

Mr. Nabokov also composed operas to librettos by Stephen Spender and W. H. Auden, three symphonies, some large concert works for voice and orchestra and concertos for piano and flute.

Despite this output, Mr. Nabokov was much better known for his achievements from 1951 to 1963, when he was secretary-general of the now defunct Congress for Cultural Freedom.

During this time he organized three spectacular festivals. The first, Masterpieces of the 20th Century, was held in Paris in 1952. The second, "Music in Our Time," was presented in Rome in 1954. The third, "East-West Music Encounter," took place in Tokyo in 1961.

Unknown to Mr. Nabokov then, much of the money for Con-

gress for Cultural Freedom activities came from the CIA. The reason for this ignorance of the true course of the money was that it was channeled through various foundations.

Recently, Mr. Nabokov has been making plans for a Stravinsky Festival to be held in 1980 in Venice, where the composer is buried.

Mr. Nabokov was born in the Minsk region of Russia in 1903. In 1911, his family moved to St. Petersburg (now Leningrad) and, after the Revolution, he went to southern Russia, where he studied musical composition with Vladimir Rebikov. Later, he went to Germany, where he studied at the Stuttgart Conservatory and, from 1920 to 1923, at the Music Academy of Berlin.

He spent an extended period in Paris, starting in 1924 with study at the Sorbonne. It was in Paris that his professional career could be said to have begun with the Diaghilev commission of "Ode." Mr. Nabokov settled in the United States in 1933 and became an American citizen in 1939.

Mr. Nabokov wrote two books of memoirs—"Old Friends and New Music," published in 1951, and "Bagatz," published in 1975.

#### Stephen E. Kelly

NEW YORK, April 7 (AP)—Stephen E. Kelly, 58, long a figure in American magazine publishing, died of cancer yesterday at the Harkness Pavilion of the Colum-

bia-Presbyterian Medical Center here.

Mr. Kelly was the last publisher of the Saturday Evening Post under the Curtis Publishing Company, and was president of the Magazine Publishers Association, an industry group made up of 161 firms that published 595 magazines.

#### Helmut Langfelder

MARSEILLES, April 7 (AP)—Helmut Langfelder, 49, director general of the West German aircraft manufacturer Messerschmitt-Bölkow-Blohm, died in a helicopter crash yesterday in this city in southern France.

He was on a test flight of a Squirrel helicopter which he was considering buying from its French manufacturer, Aerospaiale. The French pilot was also killed in the crash, which officials attributed to engine failure.

### Prisoner Amnesty Urged in El Salvador

SAN SALVADOR, April 7 (AP)—A group of lawyers has asked the National Assembly to grant amnesty to farmers arrested during an Easter week uprising in which 30 persons died.

A statement signed by 10 lawyers and 8 law students said that, since the uprising was political, the arrested peasants were therefore political prisoners. The Salvadoran penal code provides means to grant amnesty to political prisoners, the lawyers said.

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## An urgent appeal to Americans to help clean up this mess.

The whole world is aghast at the extent and the implications of the 220,000-ton oil spill.

And much of the world has already lent support to the clean-up action. The Germans have sent pumps and other technical equipment. So have the Dutch. Spanish fishermen have sent small boats. Money has come from as far away as Hong Kong and Indonesia. French school children and Belgians are in Brittany right now, helping to clean the beaches and to save wild life.

Surely Americans are as appalled as others. They must want to help. Perhaps they don't know how.

To help Americans, French and others (individuals and companies alike) who want to lend a hand, the American Chamber of Commerce in France is sponsoring and acting as a clearing house for a fund raising project entitled "Franco-American 1978 Project Brittany."

This effort has the unqualified endorsement of all leading Franco-American organizations in France. In response to our urgent request the World Wildlife Fund—U.S. and the Fondation de France have opened special accounts in Washington and Paris to receive the contributions which will be used to help

rehabilitate the beaches, to save marine life and to save the lives of tens of thousands of birds which have been endangered as a consequence of this disaster.

Contributions of every size are needed. To qualify as a charitable contribution under U.S. income tax rules checks in U.S. dollars should be made out to the order of: "World Wildlife Fund—U.S."

All other currency checks should be made out to the order of: "Fondation de France." Contributions to the Fondation de France qualify as charitable contributions for French income tax purposes.

All checks should be mailed to:  
The American Chamber of Commerce in France,  
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This is how you can actually do something about the tragedy of the French coast!  
This is how you can help clean up the mess!

FRANCO-AMERICAN 1978 PROJECT BRITANNY

Photo: Paris-March, Jean-Claude Deutsch.



## Theater in London

## Ayckbourn's Universe Is a Very Small World

By John Walker

LONDON, April 7 (IHT)—Alan Ayckbourn has deserted the comic absurdities of suburban existence for an examination of small-town rivalries in his latest and extremely funny comedy "Ten Times Table" at the Globe Theatre.

Provincial living turns out to be suburbia with claustrophobia, a small, enclosed world where everyone knows everyone else's business and where trivial matters can become magnified into national issues of life-and-death importance. Not that in Ayckbourn's universe, bleak beneath its cosy comedy, there is much difference between one state and the other. Life is death with a little oxygen added.

As usual, Ayckbourn's play is a solution of a difficult technical problem. He sets his action in a hotel bathroom—captured in all its dusty lack of glamour in Patrick Robertson's set—at a series of committee meetings of a group organizing a historical pageant to commemorate a dubious 18th-century incident in which local farmers proclaimed revolution and were shot for their defiance.

There are moments, as lights fail and workmen hammer, when it seems as if the self-imposed restrictions of the play are too much for Ayckbourn's inventiveness and that he is relying on stock situations to carry him through. But these moments soon pass.

When directing his own play, he rarely lets the action seem as

sedentary as it is, thanks to his mastery of comic detail and the sudden flurries of action around the table, culminating in a noisy farcical set piece that brings everything to a rousingly hilarious conclusion.

Ayckbourn's special talent is to invest familiar characters with a genuine humanity, showing how mildly English eccentricity can, given the right circumstance, grow into full-blown absurdity.

And what better circumstances than a historical pageant which splits the organizing committee into two factions, right wing and left wing, determined to fight out the battle in earnest again?

He is aided by an excellent cast. Especially notable are Paul Eddington as the ambitious but easily brow-beaten chairman, Julia McKenzie as his bitchy wife becoming more rabidly conservative with every confrontation with John Saltbourne's surly Marxist schoolteacher, Benjamin Whitrow as an obsessive committee man and Maryleke Gibbs as his deaf but sprightly mother. Christopher Gibbs as a twitching dog breeder who develops alarming paranoia, seeing the pageant in terms of an international Communist takeover, and Diane Bull as a speechless helper.

Even when the situations are familiar ones—such as the deaf person who can hear something said when no one else can—Ayckbourn makes them seem fresh by his mastery of timing.



A scene from "Ten Times Table" by Alan Ayckbourn which is on view in London.

His comedy is about a loss of a sense of proportion. The bleakness of his vision comes in those small revelations of character that suggest people living lives of the quietest desperation—Julia McKenzie's joy, in the final uproar, when she is seized and borne off by a drunken reveler, says much of her marriage and explains her bullying manner to her husband—When I elected you chairman," she begins one speech—and to her friends.

The Shaw Theatre, with commendable enterprise, is reviving Arnold Wesker's three plays now known as the Wesker Trilogy, which, as playwright John Witing pointed out many years ago, inclines us to approach it "on the same emotional level as the Gospels, or the Forsyte Saga."

The first, his 20-year-old "Chicken Soup With Barley," has a particularly evangelical tinge about it. What is fascinating is not only the play itself, which

stands up well despite its clumsy construction, but the difference between it and more recent Socialist plays.

"Chicken Soup With Barley" charts over 20 years the disintegration of a London East End Jewish family, symbols of a wider ideal of brotherhood and sisterhood. From an early cohesive ness—all united to stop a Fascist march through the streets in 1936—the family and their friends drift away from the Communist party and a fervent belief in imminent political change until they end up dispirited and despairing in the 1950s.

But even so, Wesker's play is basically optimistic. It retains a belief in idealism. The last words of the play are those of Sarah, the mother who has both held the family together and pushed them apart by her fighting spirit: "If you don't care, you'll die."

And earlier, Sarah, faced with her son who has lost his faith because of what happened in Hun-

gary, says, "Socialism is my light, you can understand that? I've got to have light and love."

That sort of writing is more than a generation away from the bitterness and anger of recent leftist plays, which are filled with hate or a scream of pain at the injustice of society.

The clumsiness of "Chicken Soup With Barley" comes from the equation of the Kahn family's problems with those of the world. The domestic story of a strong wife trying to batter her way through to her weak husband and only forcing him into total isolation and early senility, does not always illuminate the wider social issues of the play.

It is, however, movingly acted by Barbara Young as Sarah and Martin Friend as her husband—and by Frank Baker as Ronnie, the son who fears that he may end up like his father. Anthony Cornish directs well and makes one eager to see the two other plays in the sequence.

## —A Guide to the European Festivals—

PARIS, April 7 (IHT). — The following completes the listing of highlights of European music and arts festivals that has appeared in the weekend editions of the International Herald Tribune beginning with March 4-5. Subsequent festival program information will be carried in the Arts Agenda.

Glyndebourne (May 28-Aug. 7): Opens this year with a new production of Mozart's "Magic Flute," conducted by Andrew Davis, staged by John Cox and designed by David Hockney. Other new stagings are Mozart's "Così fan tutte," conducted by the festival's new musical director, Bernard Haitink, staged by Peter Hall and designed by John Bury, and Puccini's "La Bohème," with Bruno Bartoletti making his British opera debut as conductor and Cox as stage director, but with sets and costumes from the festival's 1967 production. Revivals of last year's staging of Mozart's "Don Giovanni" and Stravinsky's "Rake's Progress" complete the program in this small theater in a Sussex estate. (Glyndebourne Festival Opera, Glyndebourne, Lewes, Sussex BN9 5JU, England.)

Avignon (July 10-Aug. 7): The usual vast program in numerous sites in the walled city of the popes, including many new works. Theater in the main courtyard of the Palais des Papes includes Brecht's "Caucasian Chalk Circle," Beckett's "Waiting for Godot," a musical work, "Le

Nom d'Oedipe," by the composer Andre Boucourechiev, staged by Yves Prin, and two programs by the Alvin Nikolais Dance Theater. Antoine Vitez is staging a cycle of four Molière plays and Montreal's Theatre du Rideau Vert gives three pieces in the Cioleto des Carmes. Other musical theater includes works by Maurice Ohana, Lorenzo Ferraro and Monteverdi. There will be cycles of sacred music, organ music on instruments of the region, jazz, and an exhibition of 50 years of lithographs from the Atelier Mourlot. (Bureau du Festival, 84000 Avignon, France.)

Besancon (Sept. 1-17): The English Chamber Orchestra, the Camerata of Boston, the Ensemble Vocal et Instrumental de Lausanne and the Grande Ecurie et la Chambre du Roy are among the visiting ensembles. Programs will mark this year's Vivaldi and Schubert anniversaries, the tri-centenary of the joining of Franche-Comte to France and Olivier Massien's 70th birthday. The 28th annual competition of young conductors and the sixth festival of musical and dance film are also scheduled. (Festival de Musique de Besancon, B.P. 1913, 25020 Besancon, France.)

Berlin (Sept. 8-Oct. 8): The circus and its descendants are featured, with an exhibition, a film festival, circus companies

and related theatrical events. The Zurich Opera's Monteverdi trip-tick heads the opera program. Art and artists during the Nazi era will be the subject of an exhibition. The centenary of the birth of the Austrian composer Franz Schreker will be marked in concerts and a symposium. The Berlin Philharmonic will be conducted by Karajan. Boehm, Giulini and Abbado, and Dietrich Fischer-Dieskau and Maurizio Pollini will do Schubert's "Die Winterreise," heading a rich concert and recital program. (Berliner Festwochen, Budapest Strasse 48/50, 1 Berlin 30.)

Warsaw (Sept. 16-24): The 22d festival of contemporary music in the Polish capital offers numerous visiting ensembles from East and West Europe, among them the Scottish National Orchestra and the Lyric Arts Trio of Toronto, as well as programs of electronic and computer music. Events are spread out from noon to late at night. (Warsaw Autumn, 27 Rynek Starego Miasta, 00-272 Warsaw.)

Perugia (September): The 23d annual Sagra Musicale Umbra offers the customary programs of sacred and quasi-sacred music, including opera, choral, orchestral and organ music in Perugia and surrounding Umbrian cities (Piazza Italia 19, Casella Postale 341, 06100 Perugia, Italy.)

—DAVID STEVENS.

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## The Art Market

## The Confusion at Islamic Auctions

By Souren Melikian

LONDON, April 7 (IHT)—After a nine-day round of Islamic art sales which started in London March 29 with a carpet auction and ended yesterday with coins, the picture that emerges is one of continuing price confusion.

The zigzagging prices go to extremes often unrelated to quality. This came out strongly in the sales of manuscripts and miniatures.

The Tuesday sale held at Sotheby's offered some particularly striking contrasts. The items included Persian miniatures of the 14th to the 17th century, manuscripts of the same period and 19th-century oil paintings done under the Qajar Dynasty.

Lot 8, an excellent miniature painted in Shiraz in the last quarter of the 15th century, was knocked down at only £198. Less than 10 minutes later, lot 21, a late 16th-century drawing of a youth standing in a landscape, badly stained and worth less, made considerably more at £462.

Soon after, some very good miniatures of the 19th century could be bought for ludicrously low prices. Lot 40, a fine miniature painted about 1820, could not have been cheaper at £27.20. And lot 57, an excellent study of a wandering ascetic or dervish of the mid-19th century, was given

away at £38.50, the price paid by Iranian dealer Motamed of Frankfurt.

Since Qajar art has been much less in demand of late, these low figures might have been understandable if the oil paintings of the same period had not been selling for huge prices. A portrait of the eldest son of King Fath Ali Shah, painted in 1814, went up to £66,000. The signature of a well-known artist called J'afar and the historical interest of the portrait partly explain this price, but they do not make up for the dull color scheme. Another portrait of King Fath Ali Shah himself, done in the same year by the famous court artist Ali, rose to £104,500, a fabulous price.

Ironically, the finest painting, a portrait of a woman playing the lute, was the cheapest of all. Unsigned but attributed by several Iranian connoisseurs to the painter Mirza Baha, it was bought for £35,200 by Tehran collector Samad Khorsidi.

On the following day, the price of £6,600 paid at Christie's for a dagger and matching scabbard in polychrome enamels showed that, indeed, the Qajar market is still doing very well, making the underpricing of the miniatures all the more paradoxical.

Similar vagaries, however, could be observed in virtually every category.

On Monday at Sotheby's, one

of the earliest miniatures from a famous manuscript of the mid-14th century went up to £110,000. That is rather a lot, given the amount of restoration work, and it might suggest renewed interest in that transitional period of Persian miniature painting. This assumption is, however, belied by the low price of £1,900 paid for a page of the same period with a fine miniature cutting across the page in horizontal format.

## Fine Manuscript

On the following day at another auction of miniatures, also held at Sotheby's, some pieces were mysteriously overlooked, such as an outstanding manuscript of the poet Jami's works, dated 1504. This was only 19 years after Jami's death, making it an important manuscript for future critical editions. The superb calligraphy and illumination strongly suggest that it must have been prepared at Herat, Jami's city. At £990, it was a giveaway.

Even more astonishing was the price of £825 for a miniature illustrating a battle. The style leaves little doubt that it was painted by Mohammad Mo'in, a famous artist of the second half of the 17th century. The catalogue was silent on this score, nor did it properly identify the subject, which was taken from a well-known historical chronicle.

And here, indeed, lies one of



Portrait of a lute player which sold for £35,200.

the two basic causes of the uncertainties and unhealthiness of the market. The first is the existence of too many fakes and, above all, retouched, paintings or heavily made-up objects. The other is the weakness of auction-room cataloguing.

There were some surprising bloopers in the Islamic Week's catalogues. In Sotheby's Tuesday sale, a manuscript of S'adi's works executed in 1496 is located in "Turkey," while the page reproduced in the catalogue specifies it as copied at Qazvin, northwest of Tehran. In the same sale, a charming Qajar miniature portrait of a woman had a caption in Persian identifying it as the portrait of a woman from Sivand, a well-known village of the Shiraz area. The catalogue assures us that the inscription calls her "the wife of Siwand Tardik of Shiraz."

Doubtful Signature At an auction conducted last week in Paris a fine Koran was said to be by "Nishapouri." No such name was to be read in the Koran and this is not a complete signature anyway. At least three calligraphers include this word in their full name.

Most unexpected, however, was the misreading of a cartouche inlaid in gold on the steel blade of a sword sold at Sotheby's Monday. The Arabic inscription, "I have entrusted myself to God," often seen on weapons, was read as "Kalb Ali," who, the catalogue goes on, "is said to be

the son of Asadallah of Isfahan the most prominent bladesmith in Persian history." The 19th-century look of the calligraphy and the strongly Turkish appearance of the scabbard might have warned the catalogue that he hadn't got it quite right.

Sooner or later, these little mistakes get known and deter most Western buyers. And Eastern buyers have become both considerably more discriminating in their approach to the market and its many traps.

By far the best manuscript in London, an outstanding Book of Kings illustrated with 62 miniatures painted in Khorasan in 1602, was bought for £341,000 by a well-known collector, Mas'udi of Tehran. It is a key work for its period and one of the finest of that school, which makes the price acceptable.

The presence of Middle Eastern dealers is now becoming overwhelming. The latest European gallery specializing in "Islamic and Persian art" was inaugurated on Tuesday on Clifford Street, a few steps away from Sotheby's, by Naser Khalili of Tehran.

In the middle term, this presence could lead to a more perceptible connection between price and quality. But it also introduces a further element of instability. The slightest threat of unrest of any nature in the Middle East could be enough to halt purchases from the area and precipitate a market crisis.

## Around Paris Galleries

Maurice Sendak, American Cultural Center, 3 Rue du Dragon, Paris 6, to April 29.

Maurice Sendak is an illustrator of exceptional value who has succeeded in preserving the best qualities of his 19th-century predecessors while giving his drawings the freshness of modern attitudes. Parents looking for books for small children gratefully discovered the "Little Bear" books, for instance, in which the story and the illustrations are perceptive, imaginative and warm. Sendak joins Beatrice Potter Sheppard, the illustrator of Winnie the Pooh and other books, in the ranks of the tender, gifted, inconspicuous benefactors of mankind.

Gilles Aillaud, Galerie Karl Flinker, 25 Rue de Tournon, Paris 6, to April 27.

Aillaud's subject is the zoo, and at first sight he seems to treat it with an unusual, sub-photographic detachment. The cages and pits in which the animals are enclosed are sinister—the paintings themselves often present one with effects of unexpected beauty, nonetheless—and the animals are no more than inert and shapeless lumps of fur or skin in many cases. Is that a seal, or a large garden slug? But that is, of course, the way we actually do see some animals on occasion. Aillaud's intention becomes apparent through the very persistency with which he pursues it. As a painter he is a very good craftsman, but he is also a man with a message for the mind. Nor is it a simple message. His zoo is like some sort of encyclopedia where living creatures are captured in cement slots. Here we have a hippopotamus (a

first-rate painting). You don't see much of the animal really, but then, a real hippopotamus is not only that gray body, vanishing under the sumptuously filthy water—it is also the Nile. Aillaud's theme seems to be the reductive violence man exercises on words, concepts (animals perhaps) and other men. This is a surprisingly paradoxical oeuvre which Aillaud has been singlemindedly producing since at least the past 15 years, until the very oddness he conveys begins to fill with meaning and we begin to notice it.

Realisme et Poesie dans la Peinture Russe, Grand Palais, Paris 8, to May 15.

An exhibition of 86 paintings illustrating, sometimes with considerable charm, the directions taken by Russian painting between 1850 and 1905. The public outside Russia has had little opportunity to discover the works of artists who shared the preoccupations of a Dostoevski or a Tolstoy. The half century covered by this show was one of profound change, and the art movements themselves show an interesting diversity. One of the prime forces

was the Society of Traveling Exhibitions set up by a group of artists in 1870 with the intention of developing the people's love for art while reflecting the serious interests of the people. Russian artists, on the whole, seem to have had a defensive attitude toward Western influences during the period, and it would be a mistake to assume that formal similarities between some Russian and Western paintings reflect a similar outlook. In any event, there is much to charm one in this show, a strong love of light and nature in many works (Chistiakov, Larochkov). The historical painting themselves, so tedious in the French School of that period have a certain power of persuasion (Surovov, Schwartz). A number of artists dealt with current events (Repin) or tragedies of daily life (Perov, Ivanov) in a surprisingly sober manner.

—MICHAEL GIBSON

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## Music: Martinu's Surrealist Adventure

By Henry Pleasants

LONDON, April 7 (IHT)—About halfway through the first act of Bohuslav Martinu's "Julietta," given a British premiere by the New Opera Company in association with the English National Opera at the Coliseum, one of the characters remarked: "Everything's quite clear"—and the house exploded with laughter.

"Clear" was just what everything was anything else but. For this opera, dating from 1938 and based on a play by Georges Neveux, notoriously controversial in its time, is an adventure in surrealism, pure and simple. At that point in the first act the audience has not had time to come to terms with the fact that what was afoot was a dream, and that what was up might well be down—or vice versa.

That first act, in which our hero, Michel, finds himself in a small coastal town inhabited by

amnesiacs, where he alone has any remembrance of anything, is a trying 45 minutes, and there were those among the audience who, at the intermission, reported difficulties in fighting off dreams of their own.

But a second-act idyll with an unpredictable Julietta in a kind of magic forest—enlivened by a gypsy fortune-teller who foretells the past—has seductive charm. A last act, set in the central office of dreams, with our hero reluctant to awake, and finally opting for further pursuit of the elusive but ubiquitous Julietta in dreamland as preferable to the boredom of reality, exercises an irresistible fascination.

## Spoken Text

This last act benefits greatly from the fact that much of the text (in English) is spoken, quite enough of it, indeed, to demonstrate that nothing is gained in

the composition of opera by a kind of singing that, while produced by singers, is certainly not song, and is not only less intelligible, but also, in the end, less musical than speech.

As is true of most operas composed since "Turandot" (1926), the musical action is in the orchestra, as incidental music to a play, or as a kind of underscore, finely wrought and highly effective, especially as played by the ENO Orchestra under Charles Mackerras. "Julietta" would have worked better, come to think of it, as a ballet.

Anthony Besch's production, with appropriately surrealist sets by John Stoddart, has all the virtues one has come to expect at the Coliseum, including many admirable characterizations in supporting roles. And there are splendidly sympathetic performances by Stuart Kale and Joy Roberts as Michel and Julietta.

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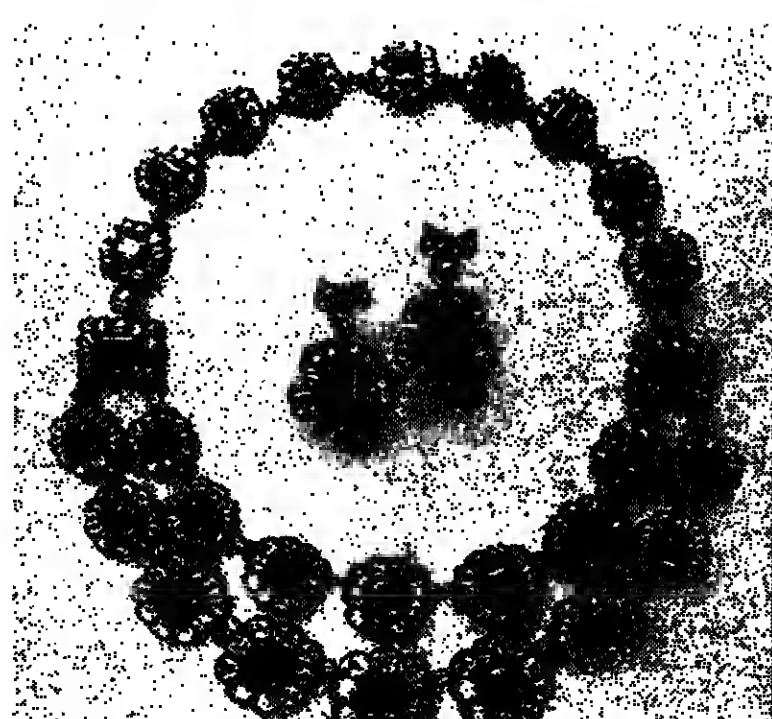
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## P A D I A L

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## Indonesia Role Dim As Future Oil Power

By George McArthur

SINGAPORE, April 7—Indonesia may cease to be a significant oil exporter far sooner than had been expected, sources say. The country, now the ninth-ranked producer among the 13 members of the Organization of Petroleum Exporting Countries, could be a net importer of oil within 10 years, at least two oil industry surveys and a study by U.S. economic experts indicate, the sources say.

Indonesia's questionable prospects are also depressing hope for a revival of the Southeast Asian oil boom which collapsed in 1975-1976. Chinese are convinced plenty of oil remains to be found, but the future pace of exploration and development is likely to be cautious and complicated.

### Incentives Low

The potential is high but incentives are low, says Allen Hatley, regional executive for Cities Service and chairman of the South-East Asia Petroleum Exploration Society. In a paper he delivered to a regional oil conference, he said that a major reason for the oil

boom of the early 1970's was the momentum and flexibility that grew from sustained exploration throughout the area. This "is rapidly disappearing," he said.

Oil officials privately put most of the blame on President Suharto of Indonesia and, to a lesser degree, the government of Malaysia.

In 1975, with Indonesia's state-owned oil company Pertamina in a \$10-billion jam from what it later termed "uncontrolled" management and overspending, Mr. Suharto needed money badly.

He unilaterally broke his contracts with all major oil companies—some only a year old—and imposed a 85-to-15 percent production split and imposed stiffer cost-recovery terms. Previously, the government took only 65 percent of the profits, after deductions for recovery costs, with 35 percent going to the companies.

Within the complex pricing-system of the oil industry, most companies found this bearable.

However, they complained vigorously, but unsuccessfully, that the new split did not provide incentives for exploration. And in Indonesia, most discoveries are relatively small, have a production life of about 5-to-10 years and continuing exploration is an economic necessity.

As a result, exploration dropped to nearly nothing. At one point, only four new wells were being drilled—all in proven areas.

Malaysia may suffer the same fate. The new government oil company, Petronas, openly fashioned on the Indonesian model but with far less expertise, imposed the same production sharing percentage. Moreover, it tried to get greater management control through some share-juggling proposals. Exploration came to a virtual standstill there, too.

While oil companies cut exploration, production peaked at 1.7 million barrels a day late in 1977 in Indonesia, and it was estimated the government's oil-export earnings for the year would reach \$4.2 billion.

**"Time Has Run Out"**

In mid-1977, Mr. Suharto attempted to stimulate oil exploration by offering marginal incentives on things such as depletion allowances and pricing details. In January, he tried again. He called in oil company executives from the United States, Japan and Europe and told them Indonesia was seeking "mutually beneficial" relationships in new contracts. There was no public response from any company. Diplomats based in Indonesia say Mr. Suharto now realizes that "time is running out" and that he must make some major concessions.

"I'm afraid that time has already run out," an industry expert says. He noted that for the most part, oil companies' exploration budgets have been set for this year, with very little provided for exploration in Indonesia. That would mean three years without new oil being found in any significant quantity.

Even if exploration is increased next year, it will take time to get possible discoveries into production. With proven reserves of only about 11 billion barrels, Indonesia does not have a very large cushion.

© Los Angeles Times

**Ocean Mining Profitable, Computer Model Shows**

CAMBRIDGE, Mass., April 7 (AP-DJ)—Deep-ocean mining of key minerals could be profitable, according to scientists at the Massachusetts Institute of Technology.

In a report to MIT's Sea Grant program, scientists say mining the ocean floor could yield a long-term return on investment of 15 to 20 percent. The idea is to scoop, or vacuum, ferromanganese nodules from the sea floor. Such nodules, averaging about the size of tennis balls, are found in abundance, particularly in some parts of the Pacific Ocean, the report says.

By running data through a computer model of such a mining venture, the MIT group reckons annual revenue through the sixth to 30th year might be about \$250 million after operating expenses of \$100 million. They also figure the recovered nodules would contain about 1.5 percent nickel, 1.3 percent copper, 0.24 percent cobalt and 26.9 percent manganese.

The study was compiled by MIT students under the direction of J.D. Nyhart, an associate professor of management at MIT's Sloan School of Management.

The purpose of the model is to enable governments and companies to analyze how various policy options and economic factors could affect a deep-sea mining venture.

Although the model is flexible and able to use a variety of different assumptions, the basic venture it is concerned with involves a "mine site" about 18,000 feet below sea level, about 2,640 miles from the nearest port with about two pounds of nodules per square foot.

The venture would require investment of about \$560 million before it began to return any income from the sale of refined minerals.

According to the report, four concerns have spent an estimated \$100-to-\$150 million on ocean prospecting, exploration and research and development.

Members of these groups included affiliates of U.S. Steel, Royal Oil, Kennecott Copper, Inco Ltd., Standard Oil of Indiana, Sun Oil, Dutchell group and Lockheed, among others.



Robert Tuck Jr.

## PEOPLE IN BUSINESS

Detroit Diesel Allison, a division of General Motors, has named Robert Tuck Jr. as manager of European operations with headquarters in Rotterdam. He was formerly based in Michigan.

Peder Bonde, formerly deputy chief executive of the Scandinavian Skandia Bank and the Salen shipping group was appointed president of the Banque Scandinave in Suisse. He is replacing Dietrich Hamann who is retiring. Thomas Goossens, previously vice-president of Deltec Banking Corp. in Nassau, was appointed senior vice-president.

## Swiss Banker Convicted For Fraud

BASEL, April 7 (AP)—A Swiss banker was sentenced today to three years in prison for fraudulently manipulating "numbered accounts" of foreign clients. Arthur Krieg, 54-year-old former Basel-branch manager of the Amexco Bank, convicted after a six-week trial held largely behind closed doors to protect the clients' anonymity, was found guilty of embezzlement, forgery and criminal mismanagement that lost the bank \$3.8 million.

A key figure at the trial, according to court sources, was an internationally known foreign-exchange dealer who specializes in transactions for customers in East Europe. Judges referred to him as "Monsieur Agent X."

Krieg denied the embezzlement charge but admitted he engaged in risky operations aiming to recover losses his clients suffered because of unsuccessful speculation. The prosecution charged that Krieg kept about 1 million francs for himself. His lawyer portrayed the defendant as an ambitious banker who had been under "performance pressure" by his U.S. bosses and resorted to illegal dealings to hide his inability.

**U.S. Adopts New Goals  
For Strategic Stockpiles**

WASHINGTON, April 7 (AP-DJ)—The Carter administration has adopted new goals for stockpiling strategic commodities that will require large acquisitions and in some cases, disposals.

Fred Bergsten, Assistant Treasury Secretary said today.

"It will take several years to fulfill these goals," Mr. Bergsten said while speaking at an American Mining Congress conference in Phoenix. "Thus, the requests for approvals of acquisitions and disposals which have been transmitted to Congress for fiscal year 1978 through 1980 are only a beginning."

For example, tin disposals are now scheduled for no more than 45,000 tons, though 167,000 tons of tin now in the stockpile are considered surplus. Similarly, legislative authority is currently pending for the purchase of up to 225,000 tons of copper, far below the goal of 1,299,000 tons," he said. "The administration is also supporting the principle of using proceeds from sales of surplus materials to purchase deficit materials," he said.

**Commodity Agreements**

"We are willing to hold these funds in a separate account for about two years. However, we oppose holding such proceeds indefinitely in escrow to fund future purchases. Such a procedure would violate accepted budget practice by tying up idle funds" for several years, he said.

Mr. Bergsten also outlined the administration's views on international commodity agreements. He said that "only a handful" of such agreements now seem feasible,

## Stocks Gain In Active NYSE Trade

**Fed Report Calms  
Tighter Credit Fears**

NEW YORK, April 7 (IHT)—Prices on the New York Stock Exchange rose slowly but steadily from a mixed beginning to finish broadly higher in active trading.

Analysts said investors were pleased by the money-supply figures released yesterday showing a much smaller gain than expected, indicating the Federal Reserve Board might not have to tighten credit as much as had been thought.

In addition, they said the market's ability to eke out a small gain yesterday despite disquieting news on inflation was a big plus.

The Dow Jones industrial average gained 5.63 to 769.58.

Volume totaled 25.16 million shares, down from 27.36 million yesterday.

Advances led declined 846 to 521.

Airco, delayed at the opening, rose 5/8 to 49 1/2 and Martin Marietta gained 1/4 to 26 1/4.

Talcoott National rose 1/4 to 4 1/4 and Gulf & Western gained 5/8 to 769.58.

Marshall Field rose 1/4 to 24 1/4 and Holly Sugar 3/4 to 24 1/4.

Warner Communications gained 1/4 to 36, Superior Oil 1/4 to 25 1/4, Vornado 1/4 to 10 1/4, Ansel 1/4 to 10 1/4, Becton Dickinson 1/4 to 37 1/4 and Centex 1/4 to 14 1/4.

Electronics stocks were strong with Teledyne up three to 79 1/4, Texas Instruments 1 1/4 to 67 1/4, Memorex 1 1/4 to 35 1/4 and Applied Digital Data one to 15.

**Amex Index Record**

American Stock Exchange prices closed sharply higher in active trading.

The Amex market-value index rose 0.96 to 131.81, a new 4 1/2 year high.

In Chicago, wheat closed substantially higher, corn and soybeans irregularly higher and oats higher on the Board of Trade.

Good export sales in corn and soybeans, and rumors of possible wheat business with China triggered an active supportive mood across the floor.

Commercial buying dominated in wheat and soy, the latter also attracting support from commission houses.

Earlier rumors influencing the market mention China and the Soviet Union as potential buyers of U.S. soybeans and corn. The outside markets were higher.

**South Korea Reserves**

SEOUL, April 7 (AP-DJ)—South Korea's foreign exchange reserves fell \$118 million in March from the previous month to \$4,255 billion. But this was up \$1.06 billion from a year earlier, the Finance Ministry reports.

The second consecutive monthly decline was attributed largely to repayment of short-term foreign loans.

**Car Workers Reject  
Leyland Bonus Plan**

LONDON, April 7 (AP-DJ)—Workers at the car division of British Leyland have rejected by a 2-to-1 margin a scheme for productivity bonuses of up to £8 a week.

Leyland had offered the plan in a bid to increase lagging output following a company finding that productivity in the division is only 45-to-65 percent of that achieved by other major European car makers.

**General Dynamics Feud Worries U.S.**

NEW YORK, April 7 (AP-DJ)—A long legal battle between the Navy and General Dynamics over a contract to build 18 nuclear submarines is making Pentagon officials increasingly concerned about the long-term impact on other defense programs.

These worries surfaced recently when General Dynamics after three years of unsuccessful attempts to renegotiate terms of the money-losing contracts—announced a decision to stop work on the boats at its electric boat division on April 12.

Yesterday, however, the Navy announced it would pay General Dynamics \$66.5 million as part of a provisional settlement of cost overruns claims. The Navy also said review of cost overruns claims was continuing.

In response to the Navy's announcement, General Dynamics said it would wait until June 12 before halting the submarine work. Meanwhile, delivery of the 16 submarines still to be built is running up to 3 1/2 years behind schedule.

Defense Department officials say the cost overruns and delays in the program were a factor in the administration's recent decision to scale down the Navy's long-range shipbuilding plan. In addition, they concede that problems with the submarines are contributing to delays in the deployment of Trident ballistic-missile submarines, which are also being built by General Dynamics.

Some Pentagon officials also worry that severe losses by General Dynamics on its submarine work could jeopardize the company's ability to perform on other important defense contracts, including the Airforce's F-16 fighter program and development of the new cruise missile.

General Dynamics officials assure that the company, which recently reported record 1977 earnings, is in good financial health.

## FINANCIAL NEWS AND NOTES

**VW to Boost Dividend, Raise Capital**

Volkswagen plans to increase its dividend and raise 900 million Deutsche marks in new capital through a 3-for-1 new share offering. The shares, having a nominal value of 50 DM, will be sold for 150 DM. This will raise the company's nominal capital 300 million DM to 1.2 billion DM. The automaker plans to increase its dividend to 7 DM per share from 5 DM paid in 1976 and also pay a bonus dividend of 1 DM. The capital increase is the first since 1970. The company did not give any indication of profit or turnover for the year. In 1976, it reported a net profit of 1,004 billion DM on group turnover of 21.42 billion DM. VW gave no details of how it would use the capital increase, although it has previously reported that it plans to boost investment spending the next four years to 4.9 billion DM from 2.3 billion DM originally earmarked.

**Airco Agrees to Takeover by BOC**

BOC International Ltd., ending its bitter takeover dispute with Airco, plans to make a \$50-a-share tender offer for all of Airco's outstanding common stock. The offer will be made "at the earliest practicable date" and has the approval of

the Airco board which rejected a similarly-priced offer from Mario-Marietta. Marietta acquiesced, saying it has no intention to enter a bidding contest. An insurgent majority of the Airco board had attempted to arrange a merger with Mario-Marietta to block BOC, which already owns 54 percent of Airco. BOC acquired 1.8 million Airco shares, at \$43 each, through a tender offer in January. Those who tendered their holdings at that time are to receive a further payment of \$7 per share from BOC upon the completion of the current tender offer. BOC and Airco, both makers of industrial gases, have agreed to drop various law suits.

**Toshiba, Rank Organisation to Link**

Tokyo Shibaura Electric, maker of Toshiba appliances, plans to extend capital and technical assistance to the Rank Organisation of Britain. A spokesman for the Japanese concern says negotiations for the deal started last autumn when Rank Radio International Co. sought Toshiba assistance for the production of color television sets. Rank is a major movie, optical and electronic instrument maker which holds about a 10-percent share in the U.K. color-television-set market.

**Pentagon Fears Wide Impact**

## General Dynamics Feud Worries U.S.

despite the submarine-contracts problems.

Last year General Dynamics had a 4-percent increase in net income to \$103.4 million, or \$9.51 a share. The company has not posted losses on the submarine contracts since 1970. One reason is that it has spent about \$400 million of its own money on the submarine program. The company has indicated it would be inclined to resume paying a dividend if the contract problems could be resolved.

The dispute over the submarine contracts is part of a broader conflict between the government and shipbuilders. The Navy is processing \$2.7 billion of contract claims, filed by its major shipbuilders—General Dynamics, Newport News Shipbuilding & Dry Dock, a unit of Tenneco, and Litton Industries.

The Navy is under great pressure to settle with General Dynamics because it is paying a heavy price for the submarine problems. The Navy says General Dynamics, to help cut losses on the submarines, diverted manpower from the important program for Trident strategic-missile submarines. As a result, the Trident are running up to 18 months behind schedule, and the first boat is expected to cost \$1.2 billion, 50-percent more than expected.

## Jobless Rate Up To 6.2% in U.S.

WASHINGTON, April 7 (AP-DJ)—The U.S. unemployment rate rose to a seasonally adjusted 6.2 percent in March from 6.1 percent in February, the Labor Department said today.

The increase was the first since August, when unemployment climbed to 7 percent. Higher unemployment among black women and black teenagers was the main reason for the March rise.

Despite the increase, the department said the total unemployment picture was "little changed" last month. A spokesman said the March rise was due to "rounding up the numbers."

For the first quarter, the unemployment rate averaged 6.2 percent, compared with 6.6 percent in last year's fourth quarter and 7.4 percent a year earlier.

A breakdown by race shows that the job picture for whites was unchanged with an average unemployment rate of 5.3 percent. Black unemployment rose from 11.8 to 12.4 percent with all the deterioration among women and teenagers.

White House Press Secretary Jody Powell said that "we clearly are disappointed with the rise in black unemployment" and added that the administration will continue to "pursue a policy of dealing with inflation and unemployment at the same time."

## Growth Flat In Quarter, Official Says

**U.S. Rebound Seen  
Later This Year**

WASHINGTON, April 7 (AP-DJ)—The U.S. gross national product was flat in the first quarter of 1978 while labor costs were rising, but there will be a rebound in the second quarter, Carter Administration officials forecast today.

The first-quarter GNP in constant dollars probably was little changed from the previous quarter, Courtney Slater, the Commerce Department's chief economist said today.

She said her preliminary judgment on first quarter growth—even considering the bad weather and coal strike—is that it "would have fallen short of the 4-to-5 percent annual rate which we would like to have seen."

Mrs. Slater, speaking before the Joint Economic Committee of Congress, said her comments reflect her own judgment based on the limited data that is available. First-quarter performance "obviously is disappointing but our expectations continue to be for strong growth of GNP during the remainder of the year."

**Rapid Growth Needed**

She said it must be remembered "however, that extremely rapid growth in the remaining quarters of 1978 would be necessary in order for earlier growth forecasts for the year as a whole to be fully met."

Labor Statistics Commissioner Julius Shiskin said the economy is doing well, but he sees continued reduced productivity looming as an obstacle to expansion.

Mr. Shiskin told the committee that last year, productivity grew 2.6 percent, down from 4.2 percent in 1976. He said this helped boost growth in unit labor costs to 6.1 percent from 4.7 percent. He said it appears there will be a "decline in productivity for this year's first quarter with an attendant increase in unit labor costs." But continued employment force "increases indicate that employers are gearing up for an expected economic rebound that is likely in the second quarter."

Mrs. Slater told the panel that she also expects the economy to bounce back during the second quarter, noting available preliminary data indicates consumption expenditures for goods were weak in January and February following an abnormally strong fourth quarter.

She said despite a surge in March, unit sales "of automobiles for the first quarter fell below last year's fourth quarter." She said business fixed investment expenditures in the first quarter were held down by lower business automobile purchases and by reduced construction activity. She added that bad weather caused a "reduction in first-quarter residential construction while real disposable income probably was essentially unchanged."

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# FOLLOW FASHION WITH HEBE DORSEY.



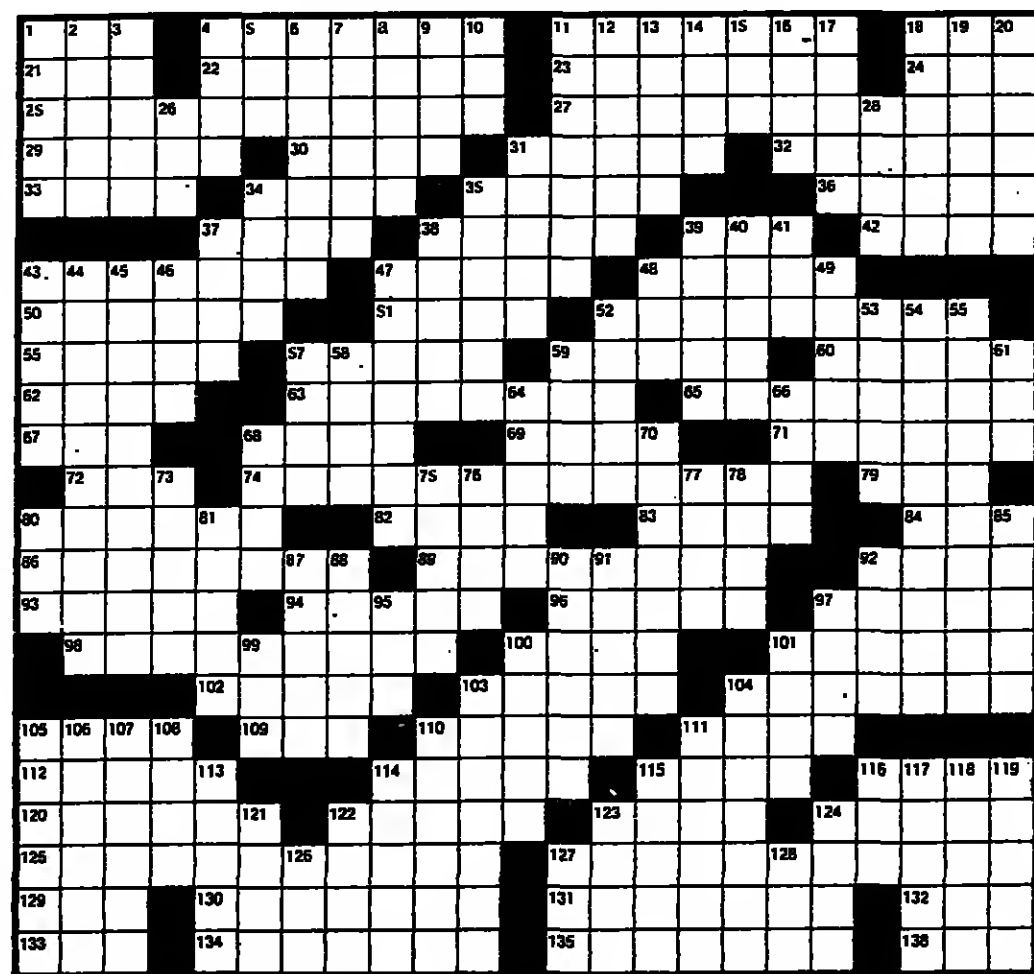
**PUT YOUR MONEY WHERE THE NEWS IS.**



## CROSSWORD PUZZLE

Edited by  
EUGENE T. MALESKA

Aviary By Christopher Busch



| DOWN                          | DOWN                            | DOWN                           | DOWN                          | DOWN                         |
|-------------------------------|---------------------------------|--------------------------------|-------------------------------|------------------------------|
| 1 Warbler from Detroit        | 20 Pulled out the spurry        | 47 German rifleman             | 76 Koko's weapon              | 108 Hardens, as cement       |
| 2 Ruhrerneck                  | 26 Rocketry expert              | 48 Bill's fullower             | 77 Annoys                     | 110 Frutty wave              |
| 3 Financial backer            | 28 "Downstairs" character       | 49 Precollege exams: Abbr.     | 81 Lay (falt)                 | 111 Two-seated carriage      |
| 4 Transvaal settler           | 31 Tear drier, for short        | 52 Bird of prey                | 85 Isles in Malay Archipelago | 113 City on the Meuse        |
| 5 Hurace's "Puetica"          | 34 Endings with court and front | 55 Walks with heels turned out | 87 Bird sound                 | 115 Writer James             |
| 6 Winged insects              | 35 Bird's back, wings, etc.     | 57 VW competitor               | 88 Destiny                    | 116 Mountain pass            |
| 7 Office fixture              | 37 Stuts spot                   | 58 Muir figurine               | 90 Feathers                   | 117 Goose genus              |
| 8 Bustard wing                | 38 Mure calamitatus             | 59 Prup up                     | 91 Archie's "dingbat"         | 118 Rural crossing           |
| 9 Brains, in Brest            | 39 Juker                        | 61 Made of wood                | 92 Alan or Robert             | 119 Weatherman's device      |
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| 11 Unfold                     | 41 Chemical suffix              | 68 Gander or drake             | 99 — relief                   | 122 Sluvenly woman           |
| 12 Electron tube              | 43 Brilliance                   | 70 Stills' kin                 | 101 Dummu                     | 124 Order or arrangement     |
| 13 Ramfis, in "Aida"          | 44 Falcons' concerns            | 73 —, Lietard, Fr. mining town | 103 Toledo team               | 126 Ruminant poet's minigram |
| 15 Ending with graph and cord | 45 Bird site in California      | 75 Arlene and Roald            | 106 Dawn                      | 127 Hdqrs.                   |
|                               | 46 Wrestling throw              |                                | 107 Found fault with          | 128 Goose egg                |

## ACROSS

- 1 N.Y.C. skyline letters  
4 Berry-bearing  
11 St. Louis Cardinal  
18 Curvilinear  
21 Fish-eating  
22 A.L. team  
23 Adm. Byrd was one  
24 Castilian rah  
25 Owners of 21 merit badges  
27 Hippopotamus  
28 Villain's trademark  
29 Auk genus  
31 Nelsms  
32 In high spirits  
33 Like a snipetish  
34 Sued for a plot  
35 Purplish color  
36 Lord or vassal  
37 Rise high  
38 Beatrice's idolater  
39 Accr.  
42 Stone novel  
43 Aquatic specialists  
47 High —  
48 Feters  
51 Pseudo-esthetic  
52 March style  
56 Fra — Lippi  
57 Kukumu product  
58 Delays  
60 Putter's clay  
62 Author Eliav  
63 Ornamental plume  
65 Emergency funds  
67 Eagles' objectives  
68 Outcast  
69 Play by Nuyes; 1915  
71 Busy  
72 Clerical degree  
74 What one has at the top

## ACROSS

- 70 Northern  
80 Rational  
83 Algerian seaport  
84 Certain articles  
85 Curved pipe  
86 Nags  
92 Aleutian island  
93 Broadway hit  
94 Selussie  
96 Literally, that is  
97 Leader after  
98 Pericles  
99 Cultraturas  
100 Agitated state  
101 Round Table knight  
102 — Peak, U.S.S.R.  
103 Blanc and Cenis  
104 Jack  
105 Oempey's birthplace  
106 Hucks  
109 Bath, for one  
110 Sudanese group  
111 Chore  
112 Christmases  
114 Fountain  
115 Carefree adventure  
116 Timberlane of fiction  
120 Ground down  
122 Hall of Fame pitcher  
123 Oispatched  
124 Lone Ranger's sidekick  
125 Carroll and Orwell  
127 Pride or envy  
129 Palindromic word  
130 Egg part  
131 Gov. Castro's bailiwick  
132 "... and Memories of —": Poe  
133 Small boy  
134 Homesteaders  
135 In a vite manner  
136 Famine ruff

## Solution to Last Week's Puzzle

|       |      |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   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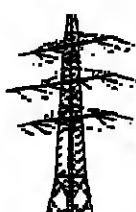












# The Role Nuclear Will Play in the Future Is the Key Question

(Continued from Page 1)  
reckoned on was the slump in electricity demand during the recession, the financial difficulties of the utilities at a time of soaring building costs, the growing environmentalist opposition and the election of President Jimmy Carter.

When nuclear technology was first developed after the war, countries adopted systems that suited their respective resources and technologies. The United States, with a monopoly in enriched-uranium facilities, opted for light-water reactors—either pressurized or boiling models. Canada, with expertise in heavy water, developed the Candu reactor operating on natural uranium and cooled by heavy water. France and Britain chose the graphite-gas route using natural uranium and gas cooling. When France acquired enrichment capabilities, it followed the example of West Germany and adopted light-water technology, while Britain merely incorporated enriched uranium in a development of its existing reactors—the advanced gas-cooled reactor (AGR). After experiencing considerable difficulties with the AGRs, Britain plumped for a mixture of the Candu system with a light-water boiling reactor, called a steam-generating heavy water reactor (SGHWR).

By 1973 it was already clear that light-water technology would be the system generally adopted for conventional reactors, with the United States, West Germany and France all possessing the industrial capacity to supply this type of reactor system. By 1978 the pressurized version licensed by Westinghouse seemed to be gaining ground over the boiling-water version of General Electric.

## Next Stage

If the problems with light-water reactors were only industrial, the same could not be said of the fuel cycle as a whole or of the next stage of nuclear development. Gaseous diffusion was still the only uranium enrichment process working, while no commercial reprocessing facilities were yet available. High temperature gas-cooled reactors and breeders were still in the experimental stage.

The United States has just adopted the revolutionary high-speed centrifuge system developed

by the West Germans, Dutch and British; South Africa and West Germany have brought out "jet nozzle" systems; the Americans are working on a new enrichment process involving the use of laser beams, while the French have presented what they claim to be a proliferation-free chemical route.

Whereas the gaseous diffusion system involves large investments and heavy energy consumption, the centrifuge can be built in smaller units with much lower energy requirements. But the French, who are currently building a large gaseous diffusion plant, claim the centrifuge will encourage proliferation.

"With a centrifuge system you can produce enough enriched uranium for a bomb in three days, with the jet-nozzle system it will take three weeks, with the gaseous diffusion method three years, with our own chemical process 30 years," claims a spokesman for

France's Commissariat à l'Energie Atomique (CEA). "The process is not economic, but it is virtually proliferation proof."

Reprocessing technology has been understood for years, but France is the only country that actually has a commercial plant in operation. As their contribution to the non-proliferation battle, British and U.S. scientists have just suggested a reprocessing technique that would leave some dangerous fission products in the plutonium to prevent it from falling into undesirable hands.

In 1973 it looked as if high-temperature, gas-cooled reactors, using a mixture of highly enriched uranium and thorium as fuel, might soon become commercial. Operating at temperatures of around 950 degrees Celsius, these reactors would have offered valuable heat for industrial purposes such as coal gasification and hydrogen production as well as

being more efficient in the generation of electricity. Under this system uranium enriched to as much as 90 percent would have been burned with thorium to produce the fissile uranium 233.

But the bottom fell out of the market when U.S. utilities cancelled all their orders from General Atomics, and concern has since been expressed at the proliferation implications of these reactors. West Germany is now the only country that still attaches considerable importance to this technique: It is currently planning to build a combined reactor/coal-gasification complex in northern Germany.

But the fast breeder may well be the first to pass the finishing post. President Carter has, of course, expressed reservations about the breeder as part of his non-proliferation stand. Britain still hesitates over moving to a commercial unit and West Germany has yet to pass

the pilot stage. But France is pushing ahead with a 1,200-megawatt fast breeder of liquid metal, Superphenix, which is due to come into service in the early 1980s. Fueled by a mixture of plutonium and uranium 238, it will be built in south-east France.

Alternative breeder technologies have also been examined, especially in the United States. With its experience in gas-cooled, high-temperature reactors, it is hardly surprising that General Atomics should have been examining a breeder version using the plutonium fuel cycle. In the belief that uranium 233 is less dangerous than plutonium, the U.S. administration has been looking into light-water and molten-salt breeders based on the thorium cycle. But it looks increasingly as if the liquid-metal system based on plutonium and uranium 238 will win the day.

During the last two years much research has gone into ways of re-

ducing the proliferation dangers of nuclear power. The French have come up with their chemical uranium-enrichment system, British and American scientists with a safer reprocessing technique and the United States has been examining the thorium as opposed to the plutonium cycle. Yet many people in the industry wonder whether it is really possible to prevent proliferation once the nuclear business takes off.

Highly enriched uranium, plutonium and uranium 233 can all make bombs. Light-water reactors use only slightly enriched uranium, but the spent fuel includes plutonium, even if it is unusable until it has been extracted through reprocessing. Breeders using thorium instead of uranium 238 may produce little plutonium, but they manufacture uranium 233. By restricting sales of enrichment, reprocessing and breeding plants, proliferation may be postponed, but few believe

it can be prevented. If a country wants to produce nuclear weapons, it has much easier ways of manufacturing the fissile materials than using equipment built for civilian nuclear programs.

## Waste Disposal

The waste disposal question must, however, be solved if future generations are not to be endangered. With no viable techniques yet developed to store spent fuels from reactors, many people believe reprocessing is not only more economical, but safer. Once the uranium and plutonium have been extracted from the spent fuel, the radioactive material left takes up so little room that it can easily be incorporated into glass cubes, inserted into huge concrete blocks and buried in granite rocks, clay or salt deposits. The real threat to future generations may well come from the huge volume of unprocessed

fuel—including highly radioactive elements—that is beginning to pile up around the world.

Further ahead is the energy potential of fusion as opposed to fission. Based on the principle of the hydrogen bomb, fusion is created by bringing together the hydrogen isotopes of deuterium and tritium at 100 million degrees Celsius. Deuterium is freely available in seawater and tritium can be made from a relatively uncommon mineral, lithium; but the process of maintaining fusion at such temperatures is very difficult.

The problems involved are greater than those faced in putting a man on the moon," says Melis de Terra, of the International Energy Agency. "But if they are solved, the world will obtain a virtually limitless source of energy."

Two methods are being explored to attain fusion-magnetic confinement and fusion by laser. Under the first approach hot gases are contained within a doughnut-shaped device called the Tokamak by a magnetic field. Schemes of this kind are currently being pursued in the United States, Japan and the European Economic Community. Under the second method, being tried in the United States, deuterium-tritium pellets are bombarded by laser beams.

## Hardware

The IEA is sponsoring two million dollar hardware projects in the field of magnetic confinement fusion research. One, which is being carried out in the United States, is designed to develop materials capable of withstanding the very extreme fusion temperatures; the other, which is taking place in West Germany, is trying to develop superconductor magnets of a size never before attempted. Only recently Britain was chosen to carry out the JET fusio experiments that are being financed by the EEC.

Fusion is still very much a dream in the minds of scientists, but fusion is very much a reality. Anti-nuclear forces may have a case when they argue that the world's energy needs could be met without nuclear power, but others feel that their arguments may have come a little late in the game. For good or for ill, Pandora's box has been opened. —M.P.

## Tapping Geothermal Power: Complicated, Expensive

PARIS (IHT)—When geothermal power is mentioned, most people immediately think of hot-water geysers in Iceland, of the dry steam fields in California and northern Italy or the hot brines found in New Zealand. But what is not generally realized is that geothermal energy can be found everywhere under the earth's crust, provided one goes deep enough.

As a general rule, the earth becomes warmer by one degree Celsius for every 30 meters penetrated below the surface. So a depth of 3,000 meters is needed in order to obtain water warm enough for district heating.

However, there are many areas in the world where such temperatures can be found much nearer the surface. Volcanic regions like Iceland are the most obvious sites, but there are many lesser-known areas where the exploitation of geothermal power should be possible. According to a United Nations study, world geothermal reserves may be as much as 7,000 billion tons of oil equivalent.

But for the moment little more than 6,000 megawatts of this power

is being tapped, 80 percent of it in the form of warm water as opposed to electricity generation. Among the areas enjoying geothermal power are Iceland, Hungary, northern Italy, the Paris region in France, New Zealand, Japan, Siberia, Chile and the West Coast of the United States.

There are two main types of geothermal reservoir—those of low temperatures varying from 60 to 120 degrees Celsius which can be found at between 1,500 and 2,000 meters in sedimentary basins, and those of high temperatures varying between 200 and 350 degrees Celsius located in depths of a few hundred to several thousand meters in areas of relatively high volcanic or tectonic activity.

## Hot Rocks

While the former, appearing in the form of hot water, can be used only to heat homes or greenhouses, the latter, in the form of either dry steam, wet steam or hot rocks, can also be used for generating electricity. Hot rocks exist everywhere, but it is only in some areas that they are near enough to the surface to be exploited.

*The areas most suitable for geothermal applications have already been exploited....And the exploitation of the hot rocks remains far too expensive for consideration in the short term.*

Low-temperature geothermal power is to be found in Iceland, Hungary, France and the Soviet Union. Paris, for example, is sitting on a huge reservoir of low-temperature water. Europe's spas are no more than geothermal fields.

High-temperature geothermal can be found in the form of dry steam at Larderello in northern Italy, at Valle Caldera in New Mexico and at the geysers in California, and in the form of wet steam or hot brine at Wairakei, New Zealand, at Imperial Valley, Calif. and El Tatio, Chile. Hot rocks can, of course, be found everywhere, but

only in some areas such as Stuttgart are they close enough to the surface to be exploited.

The use of hot-water springs for homes poses few problems except for the installation of piping to the houses and the corrosion caused by the salinity of some of these waters. In countries prepared to invest in a pipeline network to carry residual heat from power stations, factories and waste processing plants, water heated geothermally could easily be incorporated into the system. However, such low-temperature reservoirs are often far from major consumption centers and there are lim-

its to the distances over which hot water can be transported without losing its heat.

## Complicated

Exploiting dry and wet steam is a more complicated business. Not only may the steam have a high salinity content resulting in the corrosion of equipment, but it also includes unpleasant hydrogen-sulfide emissions.

When used for electricity generation, as at Larderello, the California geysers and at Wairakei, efficiency is only about 15 percent and waste is therefore much higher than with a conventional power plant. At Imperial Valley, the corrosion problem is being solved by transferring the heat of the brine to another liquid such as isobutane through a heat exchanger made of special non-corrosive alloys and then reinjecting the brine into the reservoir.

The exploitation of hot rocks poses major technological problems and remains uneconomical. At Los Alamos in the United States attempts have been made to extract heat from dry rocks by the hydrofracturing techniques developed

in the oil business. Two holes are drilled into the rocks, pressurized water is injected into one of them and, if a suitable connecting crack can be found, heated water or steam should then come up the other.

Another technique is being tried out at Urach, near Stuttgart, with the support of the European Economic Community. Under this method only one hole is drilled, into which two insulated tubes are inserted. Pressurized water is injected into the one and heated water or steam should then come out of the other.

The areas most suitable for geothermal applications have already been exploited. Development of hot-water pipeline networks based on waste heat from power stations could make new geothermal reservoirs economic, but their distance from major consumption centers will remain a problem. The use of geothermal power for electricity generation is economic only in favorable conditions such as at Larderello or the California geysers. And the exploitation of the hot rocks remains far too expensive for consideration in the short term. —M.P.

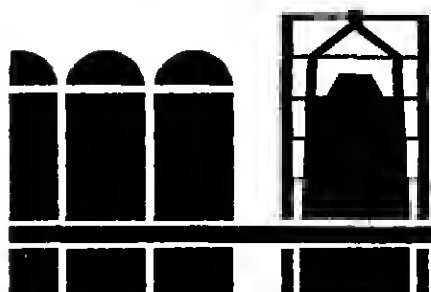
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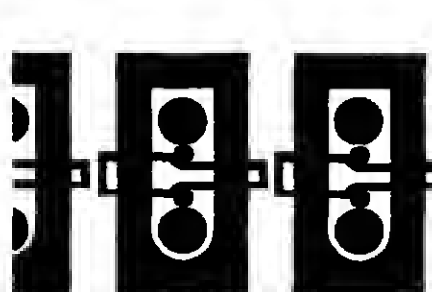
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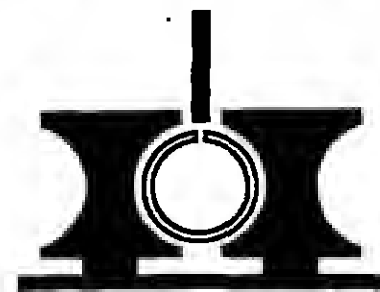
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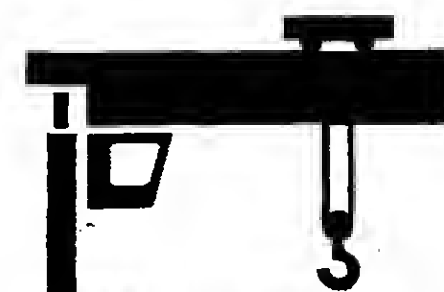
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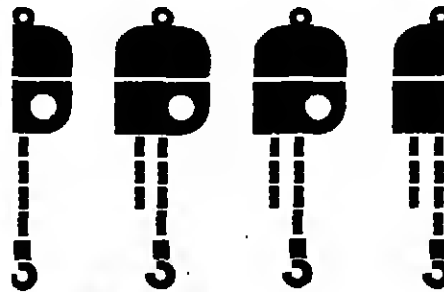
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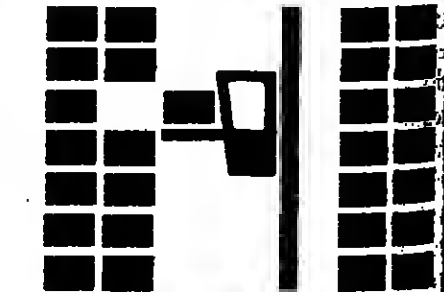
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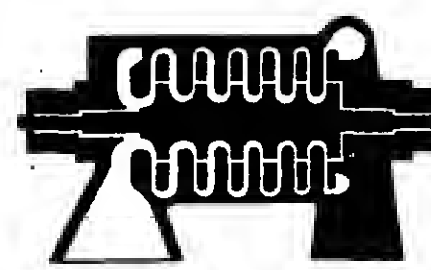
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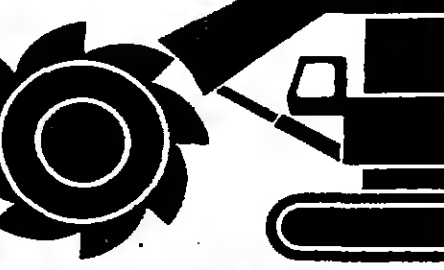
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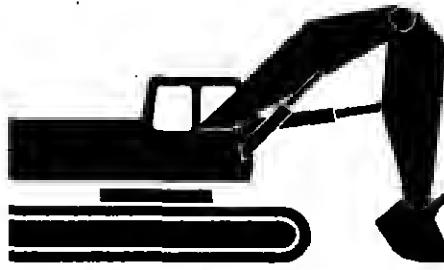
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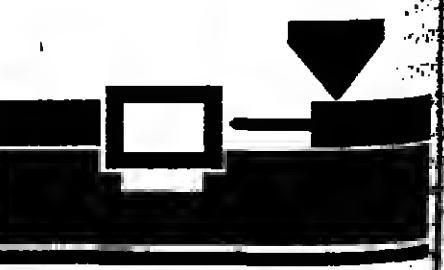
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# Solar Power: Major Impact Unlikely Before Turn of Century

BRUSSELS (IHT)—In Europe more and more households are turning to solar water heating. In the United States the sun is being used increasingly to heat homes. In the Third World solar-powered water pumps are giving new hope to farmers in arid West Africa. Solar power is becoming a reality.

Earlier this year the U.S. government agreed to fund a 360-megawatt electricity generator—cum-heater based on photovoltaic cells to be used in a school in Arkansas. It will be the biggest plant of its kind ever built, and solar cells and concentrators supplied by Solarex will only cost \$6 a watt. Five years ago the largest photovoltaic generator was no more than a few kilowatts and the cells were costing as much as \$100. Now Motorola is reported to be supplying cells for an even larger unit at only \$5 a watt. It is the transition from the laboratory to the real world that is the key.

It is the same story when it comes to thermal electricity generators based on solar power. The European Economic Community is funding a megawatt central tower plant in Sicily. The International Energy Agency is sponsoring two 10-kilowatt units in Spain—one using the tower concept, the other a solar boiler or distributed system. The United States is financing a 10-megawatt tower unit in Barrow, Calif. The Sicily plant is expected to produce electricity at less than \$7 a watt.

## Competitive

With the two systems running neck and neck, it may be only a matter of years before solar-based electricity becomes competitive with that produced from fossil fuels. Electricity production costs with thermal generators are not expected to fall much below \$2, but U.S. companies reckon that by the middle 1980s solar cells could be generating as little as 50 cents.

Even when the other capital costs are taken into account, this could put photovoltaics in the time range as conventional generating methods," says Wolfgang Ullrich, who specializes in solar energy at the EEC Commission. "At the moment electricity produced by conventional methods costs between 50 cents and a dollar per kilowatt-hour."

But it is only the environmentalists who believe that solar energy

can play an appreciable role before the turn of the century. Even by the year 2000, solar power is not expected to meet more than 5 percent of U.S. energy needs, and 3 percent of those of the Common Market countries.

Solar power may be economically viable for water heating and swimming pools, but only in new installations. Third World countries without national electricity grids may be attracted by the low-capital costs of solar power, but their purchasing power remains limited. For space heating and electricity generation the sun is still not an economic proposition.

"It is now economic to install solar water heating," says Albert Strub, research director on alternative energies at the EEC. But when it comes to space heating, many countries feel the money would be better spent on better insulation rather than on solar equipment."

## Greatest Promise

Of all energy sources, however, the sun holds the greatest promise. Wind and water are, after all, the result of the sun's rays; wood and crops are nothing but short-term energy carriers; fossil-fuels are solar energy stored over the centuries. Rather than extract this energy indirectly, why not tap it directly?

So long as no solution has been found to the transmission of electricity over long distances, the idea of using the Sahara or the Arabian desert as the world's energy source must remain a pipe dream. The problem of widespread use of solar within consumer countries concerns the environmental impact as much as its cost. But in countries that are sparsely populated and have yet to develop national energy networks, solar power could well be the answer.

Solar power can either be used directly, essentially for heating purposes, or indirectly for producing electricity. When used directly, two systems can be used—the flat-plate collector or the focusing collector. When electricity is produced, it can either be from steam created by the above-mentioned systems or directly through photovoltaic cells. Of the three main systems, the flat plate and photovoltaics absorb the sun's radiation as a whole, while the focusing collector achieves

higher temperatures by concentrating exclusively on the sun's rays.

## Differences

Although there is a considerable difference in the amount of direct sunshine received in various parts of the world, the amount of solar radiation as a whole varies appreciably only in the winter. Flat collectors and photovoltaics are therefore more efficient in northern climates than is generally thought, but unfortunately their output is lowest at the very time when they are needed most.

The simplest example of the direct use of the sun's rays is the greenhouse. By using a black-plated collecting plate underneath glass—the so-called flat-plate collector—it is possible to achieve temperatures of 50 to 70 degrees Celsius. With more sophisticated techniques such as vacuums and metal coatings, temperatures of as high as 250 C. can be attained. Flat-plate collectors can be used either directly for heating or indirectly for electricity generation. Electricity with this system costs about \$12 a watt, Mr. Palz claims.

Solar-focusing collectors were developed to maximize the heat from the sun's rays. They come in two forms—the central-receiver system and the linear-focusing or distributive-collector system. In the first, mirrors focus the sun's rays on a central boiler. In the second, they concentrate them on pipes containing liquid or gas.

## Two Variants

There are two variants of the central-receiver system, the paraboloid concentrator and the central tower. Under the first, a paraboloid mirror of some 50 square meters tracks the sun, producing temperatures of around 500 degrees Celsius at its focal point. An example of such a plant can be found in Maricopa, while a larger version with fixed mirrors has been built at Font Romeu in the Pyrenees with temperatures reaching 3,500 to 4,000 C. Under the central-tower system, a number of rotating flat mirrors, or heliostats, are focused on a separate fixed boiler. Plants of this kind are being built in Sicily, Spain and France.

There are also two variants of the linear-focusing or distributive-collector system. Under the first, the

sun's rays are reflected from a parabolic trough onto pipes containing liquid or gas. An example of this system is to be installed in New Mexico for irrigation purposes, and a 500-kilowatt unit is due to be built in Spain under an IEA program. Under the second method, faceted flat-mirror segments reflect the sun's rays onto a pipeline system. The best example is a 360-kilowatt unit that stands in Maricopa. Under the central-receiver system, the apparatus must be capable of tracking the sun both horizontally and vertically, while in the simpler linear-focusing system it needs only to move vertically.

The most exciting developments

in solar energy are coming in the photovoltaic field where prices have fallen 20-fold in five years. The most promising semiconductor material is silicon, which has attained efficiencies of 17 to 19 percent. Better suited for higher temperatures are gallium arsenide cells, which can obtain energy conversions of 13 percent. But the real breakthrough could come with cadmium sulfide. Although this material currently only offers efficiencies of little more than 5 percent, manufactured as a film on a conventional "float-glass" production line, it could become as cheap as plain glass.

For the moment the main de-

mand is for the cheaper flat-plate collectors, be it for thermal uses or for electricity generation. Water heaters based on this system have been operating in Japan, Israel and the United States for years. Now they are being introduced in Europe. Prices are still high at \$1,000, but they are falling fast. In sunnier countries collectors are used for space heating with a conventional back-up. In the developing countries solar cookers never really caught on and distillation units are only economical in special cases, but the sun's rays are already used for air cooling and crop drying.

For more sophisticated needs

such as water pumping or electric lighting, generators are required. Some of these are based on flat-plate collectors like the water pumps sold in West Africa by France's Sofrelec or the same company's 25-kilowatt electric water-supply system for a town in Mexico. Photovoltaics are, however, also used in Niger, where school children can watch television thanks to sets powered by photovoltaic cells. Many people believe that photovoltaic electricity units may be the answer to poor rural areas in the Third World that cannot afford access to a national electricity grid.

If photovoltaics seem ideally

suited to special situations, focusing collectors are only really suitable in very sunny climates. For some time to come they are likely to remain uncompetitive with conventional forms of energy.

Solar power is not likely to have much impact before the turn of the century. Its main contribution in the developed countries will be in water heating. In the developing world, without a pre-existing energy infrastructure, the possibilities for solar power are enormous. However, some system must be developed that can be produced by these countries themselves rather than exported to them by the more industrialized nations. —M.P.

# Gas: Long-Range Transport Costs a Problem

PARIS (IHT)—With world reserves not expected to last far into the next century, and U.S. gas production already on the decline, researchers are trying to develop a new artificial gas that would incorporate the whole energy content of coal-synthetic natural gas.

When gas was first used towards the end of the 18th century for street lighting in Europe, it was nothing more than a by-product of the transformation of coal into coke for iron smelting. Since it represented only part of the coal's energy content, its calorific value was low. Only in this century has this "town gas," with its harmful carbon dioxide content, been steadily replaced by natural gas with double the calorific value.

Natural gas is almost as precious as fuel oil. It has almost the same calorific value, it is extremely efficient when used for heating and cooking, it does not contain any carbon dioxide and suffers from none of the pollution problems associated with oil or coal. A source for petrochemicals and fertilizers, it can also, when converted into methanol, be used as a transport fuel. With new gasification techniques, it can be manufactured from oil or coal.

Pipelines originally used to supply town gas can be adapted to carry natural or synthetic natural gas. Eventually, if hydrogen becomes a key energy vector, it may even be transported within these same pipe-

lines, probably in a mixture with natural gas.

The world's remaining natural gas reserves are almost as great as those for oil, and they are better distributed. Some 40 percent of remaining resources are reckoned to be associated with oil reserves, with 60 percent unassociated or dry. According to the Workshop on Alternative Energy Strategies, proven gas reserves are only 386 billion barrels compared to 658 billion for oil, but some experts reckon that ultimately recoverable reserves may be as high as the 2,000-billion estimate for oil. With gas consumption currently lower than oil, natural gas may well outlive its hydrocarbon rival.

## Key Problem

But the development of natural gas as an alternative fuel to oil has been hampered by one key problem—the cost of transport over long distances. Whereas oil can be shipped from one part of the world to another at little cost, the transport of natural gas can involve very heavy investment.

This is why oil companies often do not bother to develop dry-gas discoveries, why producing countries with little domestic demand for energy are still flaring their associated gas and why electricity-generating plants are so often allowed to burn gas when it could be used much more efficiently in domestic heating or in petrochemicals. With

so much of the world's gas resources located far from the main consumption centers, transport is the key bottleneck to the increased use of gas.

There are three ways in which natural gas can be transported over long distances: It can be carried in its normal gaseous state in pipelines; it can be liquefied to a temperature of minus 160 degrees Celsius so that its volume is reduced 600-fold, and then transported in special tankers to its destination where it is reconverted into natural gas; or it can also be converted into methanol and shipped to its destination in this form.

When the gas is to be transported overland, the pipeline solution is invariably the cheapest in the long run.

The real difficulties arise when gas has to be transported across the sea. In most cases it will not even be possible to lay a subsea pipeline and the choice must lie between liquefaction or methanol conversion.

The first country to face a major transport problem was Algeria, which opted for the liquefaction route. It is in this field that most of the research has so far been concentrated.

In the field of liquefied-natural-gas (LNG) plants themselves, the market has been dominated by two companies, Air Products of the United States and Technip of France, while in transport Norway's Moss Rosenberg is mak-

ing inroads into the initial supremacy of France's Technigaz and Gaztransport.

The original technology used for building LNG plants was the classical cascade process, which has been used in plants in Algeria and Alaska and is to be taken up again in Nigeria. Under this technique, three cycles and three different fluids (propane, ethylene and methane) are used to freeze the gas.

Under separate technologies developed by Air Products and Technip, only two cycles are used—the former with propane in the one cycle and a hydrocarbon mixture in the other, while the latter uses a hydrocarbon mixture in both cycles.

In the transport sector, the membrane tank system developed by the French is competing with the self-supporting tank used by other manufacturers. Under the membrane system, the LNG is carried in the actual hold of the ship, while under the self-supporting system it is carried in a spherical tank lowered onto the tanker.

The first LNG ships were built nearly 20 years ago by the Conch group using the self-supporting tank technique. Two French companies, Gaztransport, subsidiary of Gaz de France, and Technigaz, subsidiary of Gazocéan—toyed with the idea of using a similar method, but ended up developing their individual membrane tank techniques: the one using steel with a 36-percent-nickel content, the other stain-

less steel. These tankers make up the bulk of present-day LNG fleets.

However, in the last few years Moss Rosenberg has been in the running with its self-supporting tank technique. A similar system, Semmer, is being offered by Spain's Crinavis shipyard. The advantage of the self-supporting tank technique is that the spheres can be manufactured separately, although the French claim that membrane tank vessels are simpler, safer and cheaper.

## Disadvantages

There are three major disadvantages in liquefying gas. The cost of the installations and transport facilities are enormous: 10 to 15 percent of the gas is lost in the actual liquefaction process; and there is a danger of explosion occurring at the plant or on the tanker. It is largely due to this safety factor that thought has been given to the conversion of gas into methanol, for methanol can be transported in normal ships at virtually the same cost as oil.

However, the methanol idea has never really been developed.

One idea currently under consideration is to build a collector pipeline that would pick up gas from a number of smaller fields in the North Sea. Another, more far-fetched idea would involve liquefying the gas on the spot using a floating plant.

—M.P.

# The Hydrogen Energy Concept

For reasons of environment, and to save energy, all sorts of new research efforts on power have been started. Mercedes-Benz is working on aspects of this large R & D field.

At the present state of technology hydrogen looks like being one of the future forms of power. Hydrogen is present in practically inexhaustive quantities in water, given the primary energy such as coal, required to extract it. Distribution of hydrogen in its pure form or as a mixture (town gas) offers no special technical problems. A hydrogen technology necessary to cover the present hydrocarbon energy requirement would however require considerable extension to the existing gas works and gas distribution or their reconstruction.

Hydrogen technology is especially favourable since like oil technology it can be used across the board as energy supply for domestic needs, industry and vehicles. It would seem perfectly feasible to have a combination of gas (hydrogen)/electricity for domestic and industrial purposes and, say, hydrogen/methanol for transport. For several years now Mercedes-Benz has been experimenting with hydrogen driven vehicles in practical conditions.

The normal combustion engines of today can be converted from petrol to hydrogen with some technical alterations. The key problem

is the storage of hydrogen in the vehicle and Mercedes-Benz has already shown that some new ideas can be put into practice in running vehicles. The key word is: the chemical combination of hydrogen in the form of metal hydrides. This development is being encouraged by the Federal Ministry for Research and Technology.

Hydride propulsion (hydride container - hydrogen engine) involves the following: the heat released during combustion (in exhaust gas or cooling water) has to be applied to the hydride to release the hydrogen which serves as fuel. On the other hand heat is generated when hydrogen combines with the metal (hydride formation, fuelling process) which corresponds to the motor combustion head previously stored in the metal.

By means of appropriate combination of storage of various hydrides (working at various temperatures and pressures) the whole hydrogen tank can serve the following purposes:

- Fuel containers for a cruising range of about 200 km (already feasible) to say 400 km, in future with a 200 kg tank weight and a motor of 44 kW (60 hp.).
- Air-conditioning and hence refrigeration inside the vehicle without surplus weight or any further use of fuel (use of warm air to free hydrogen from



Figure 1

- hydride with simultaneous air-cooling to -10°C).
- Heating the vehicles is based on the principle that where there are hydrides at different pressures and latent heat levels, equalisation of pressure results in the release of latent heat.
- Heat storage and retrieval in the

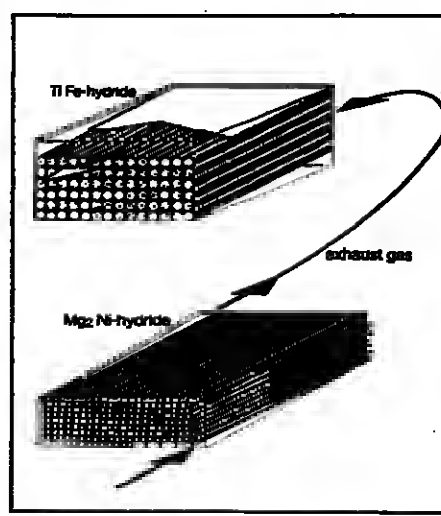


Figure 2

fuelling process through the use of a combination of various hydrides. This permits a practical heat-free propulsion of the vehicle which is particularly important in underground transport such as mines.

The hydride propulsion concept as developed by Mercedes-Benz enables one to store heat generated by engines and to choose time and place of retrieval (at fuelling) so that this fuel can be utilised.

This means that energy can be retrieved and used again e.g. in thermal power stations or zonal heating systems. The amount of energy retrievable is about 30-50% of the lower heat value of the fuel tank content. The prime energy use in the combination vehicle/district heating can therefore be raised from less than 20% (medium efficiency of engine) to over 50%.

The first world prototype of a hydride combination storage with all the functions mentioned above was

built at the end of 1976 and is undergoing practical tests (Fig. 1).

As the above considerations also apply to stationary storage, hydrides provide efficient-heat (use of surplus heat) in the domestic energy supply and free air-conditioning (use of warm air to free hydrogen from metal hydride). Given gas supply in a town (gas with hydrogen content) and the ability of hydride to absorb hydrogen out of these mixtures, there is the possibility of fuelling vehicles at the domestic gas tap. This means a steady switch from oil to hydrogen technology which allows the use not only of a pure hydrogen propulsion but also of a mixture of hydrogen and petrol (Fig. 2).

As in future the best possible use of the still available reserves of energy will be still more important than today, optimum use must be made of the supply of energy itself, and not only in respect of vehicles and households.

The initial results of Mercedes-Benz experiments show already that with the help of hydrides, electrochemical accumulators can be made especially suitable for electrical peak load storage. Furthermore, with the help of hydrides, heavy water for natural uranium reactors can be made on favourable terms, energy and price wise.

Apart from the good environmental aspects and its independence of oil, hydrogen from metal hydrides makes possible (see Fig. 3) an optimal

use of primary energy through:

- retrieval of waste heat from all combustion processes
- use of waste heat for heating and cooling
- reduction in use of energy in the production of reactor fuels (natural uranium instead of processed uranium through the use of cheap heavy water). This would mean that one could become to a large degree independent of the supply of enriched uranium and therefore of the nuclear super powers.

The production of hydrogen on a large scale would first be made through coal, possibly also gas; in the distant future these processes could be replaced by nuclear stations and possibly by thermochemical decomposition of water. As hydrogen technology has now got going as

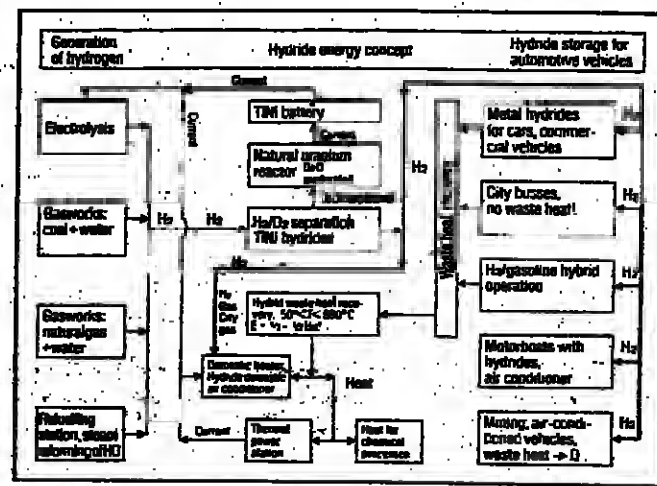


Figure 3

the result of past successes, it is likely to offer many interesting possibilities and not only for vehicle propulsion.

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# A Future for Coal, the Cinderella of the Hydrocarbon Family

LONDON—Industrial society only really began in the 18th century when coal replaced wood in the smelting of pig iron. Since then it has been used to power railways and ships, to supply heat for industry and homes, to manufacture chemicals, town gas and electricity. Although little by little, coal has had to give way to oil and gas, it was only in the late 1960s that it lost pride of place as the world's main energy source.

When future generations look back at the oil/gas era, it may appear as nothing but a brief aberration in the long reign of coal. According to forecasts made by the 1974 World Energy Conference, economically recoverable resources are six times those of oil at 3,000 billion barrels of oil equivalent, ultimately recoverable resources 12,000 billion compared to only 2,000 billion for oil. Total coal re-

sources are reckoned to be almost 50,000 billion barrels of oil equivalent.

But unfortunately coal suffers from many disadvantages: It is difficult to extract, especially when it lies underground; mining can disfigure the landscape and use up valuable water supplies; transport and handling are awkward; combustion releases dangerous sulfur dioxide, ash and particles. Only if these handicaps can be overcome, can coal resume its traditional role.

When it comes to production, the main difficulties arise underground. While high output can be achieved on the surface thanks to huge excavating machines, in the pits miners have to work in difficult conditions to extract much smaller volumes of coal. As the better seams are exploited, underground extraction could become even more difficult.

But even in underground mining, Europeans have much to learn from the United States, where productivity per man is three times as high. If coal is to have a future, production techniques must become as advanced as in the oil industry. This means greater mechanization, more efficient cutting methods, better underground transport facilities, safer working conditions and fewer miners underground.

Transport is as much a question of organization as of technology. In Britain and the United States special train delivery systems have been organized between pit and power station. U.S. coal companies have developed slurry pipelines, which carry a mixture of coal and water over long distances. The French are developing a special port at Le Havre which can receive giant coal transporters. The Inter-

national Energy Agency is pushing the development of an international coal trade.

The greatest obstacle to the development of coal is, however, the environmental problems it raises—from the damage done by strip mining to the sulfur-dioxide fumes emitted by power stations and boilers. Land reclamation is essentially a question of the amount of money a society is prepared to spend to maintain a certain quality of environment, but technology may well be able to solve coal's pollution problem.

Pollutants can be recovered from coal at three different stages—before combustion, during combustion or after combustion. Until now research has tended to concentrate on the last phase when the fumes are just about to enter the atmosphere. At first utilities only had to build their chimney stacks high enough so that the pollution was

dispersed, but now they are being forced increasingly to install so-called scrubbers that can remove over 50 percent of the pollutants.

More promising is a process under which the pollutants are removed during combustion. This is the fluidized bed combustion system currently being developed by a consortium made up of Britain's National Coal Board, British Petroleum and the National Research Development Corp. in a project sponsored by the IEA.

Under this system coal is burned in a bed of mineral particles, which are kept in a fluidized state through the injection of a high-velocity flow of gas. The advantages of this form of combustion are that almost all the coal is burned (including the pollutants), that lower temperatures are required and the boiler

can be much smaller than a conventional one.

Another approach would be to remove the pollutants through processing the coal before combustion. This can be achieved through reducing the coal into solvent refined coal (SRC) or through transforming it into low-quality gas. Gas conversion could be carried out through a conventional town-gas process or directly in situ.

But if utilities are going to convert coal into oil or gas as a means of reducing pollution, they might as well use these fuels directly rather than burn them in power stations. It is extravagant to use up 35 percent of the coal's energy in gasification or liquefaction only to waste 75 percent of what is left in electricity generation and transmission.

## Manufacturing SNG

Of course, if coal is to be used as a direct fuel to replace natural gas rather than as a low quality coal gas for power stations, it will have to be upgraded. Until now synthetic natural gas (SNG) has been manufactured from naphtha, but with increased cost of oil, research is now being concentrated on possible coal conversions.

The first research on manufacturing SNG from coal was based on existing town-gas technologies. Of the three main techniques—Lurgi, Koppers-Totzek and Winkler—only the Lurgi process operated at the high pressure required for the upgrading process. It was therefore adopted by the National Coal Board in successful trials carried out at Westfield, Scotland, in 1974. A more efficient version with a so-called slagging gasifier is currently being tested at the same center. The main aim of these experiments has been to widen the range of coals that can be converted in the Lurgi gasifier. Meanwhile Koppers-Totzek and Winkler are reportedly trying to develop high pressure versions of their systems.

But a whole new generation of gasification systems is now being developed in the United States that promises to be much more efficient. Whereas the Lurgi process uses fixed bed combustion and upgrading is carried out by methane synthesis, the new systems involve fluidized bed combustion and upgrading by hydrogenation. Among technologies being developed are

Hygas, Coga, the CO<sub>2</sub> Acceptor, Synthane and Bi-Gas.

## Coal Liquefaction

Less advanced are the coal liquefaction techniques. The conversion of coal to a liquid involves either the addition of hydrogen or the removal of carbon. Processes involving the former include direct hydrogenation, solvent-extraction hydrogenation, and the indirect use of hydrogen in the gasification synthesis. Pyrolysis processes are an example of the latter route.

While large-scale liquefaction plants have been built using the above processes, only one plant, that of Sasol, is currently in operation. This plant uses the gasification-synthesis route involving gasification through the Lurgi process followed by the Fischer-Tropsch synthesis. But now that oil prices have risen, interest has been revived in all these technologies.

Sasol is now building a second plant. A 545 ton-per-day demonstration unit is being built by hydrocarbon research using the Fischer-Tropsch process. The major technical problem with all routes apart from gasification synthesis is the separation of undissolved coal and residual matter from coal liquids and solvent.

Although the NCB has developed a process for producing as much as 50 gallons of oil per ton of coal, it remains uneconomical. "There is little scope for cutting liquefaction costs," says David Dainton, director of NCB's coal research center at Cheltenham. "It will only become economic when oil prices rise."

One of the main problems in manufacturing synthetic fuels is the energy consumed in the process. As much as a third of the coal is burned in gasification, a similar amount in supplying the hydrogen for liquefaction. One answer could be to use the heat from high temperature nuclear reactors for the conversion process. Under an extremely ambitious scheme, being

considered in West Germany, a 750-megawatt pilot high-temperature reactor will be used to produce both coal gas and synthetic oil (syncrude).

## Coke, Electricity

Coal today is used essentially for making coke and electricity. Until now it has been generally assumed that increased coal use would be limited to these two sectors. But a growing number of experts argue that when it comes to space heating it would be cheaper to convert coal into SNG rather than generate electricity with it. They also claim that SNG is cheaper than imported LNG if taxes paid to the government are excluded. But it is quite possible that coal may even have a future as a direct fuel for heating, at least for factories.

Coal has been steadily abandoned as a heating source because it is impractical, inefficient, dirty and polluting. Recent research suggests that this need not necessarily be so, however. Already finely granulated coal can be pumped into a customer's fuel tank from special trucks in much the same way as oil can. With fluidized bed combustion, factory boilers can be smaller, more efficient and less polluting. Even in the home more efficient heating appliances and smokeless fuels are making coal a more attractive proposition.

But five years after the oil crisis the future of coal still remains very uncertain. It is difficult to persuade utilities to go back to coal when oil is so much more convenient and nuclear power within their reach. After abandoning coal for oil, industry is not going to change back overnight and households are now committed to the oil, gas or electricity systems they have installed. With the constant threat of strikes by miners, the environmental damage done by mining and pollution and the effect on the atmosphere of growing carbon dioxide as a result of coal combustion, this is hardly the ideal fuel.

But amid all the pronouncements of doom and gloom, it is useful to remember that if we are prepared to pay the price, coal can provide all the services now offered by oil and gas for centuries to come. Coal may be a Cinderella in the hydrocarbon family, but its time will surely come.

—M.P.

## Wind, Water, Wood: Searching for a Better Harness

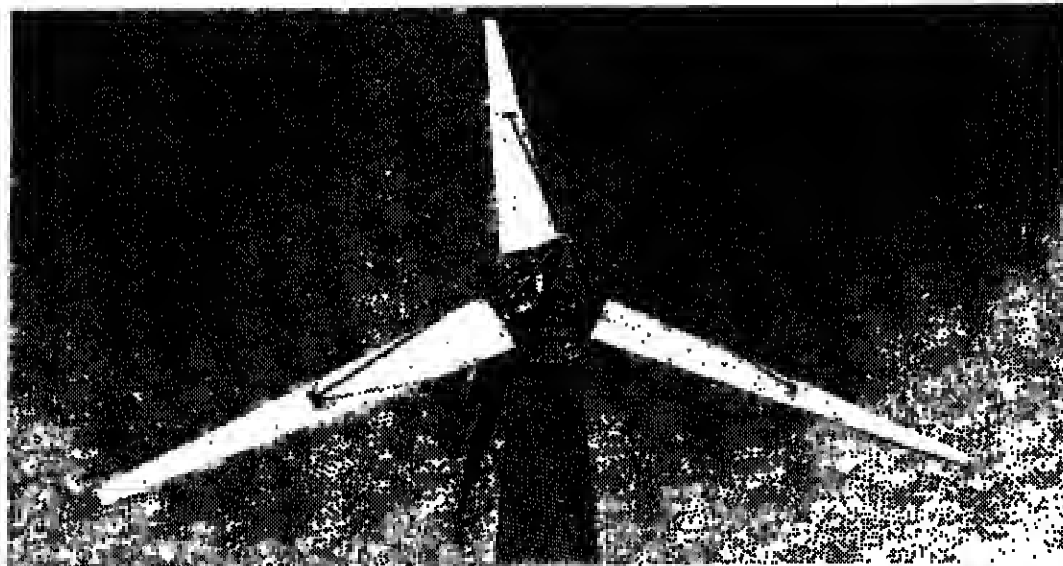
BRUSSELS—Until the discovery of the steam engine in the 18th century, man relied essentially on wind, water and wood for energy—wind to propel ships, water and wind to power corn mills and water pumps, wood for iron smelting, cooking and heating. The energy created was small, but it was sufficient to meet the modest needs of non-industrial society.

Now that the fossil fuels that have played such an important role in industrial society are in danger of running out, the question is being asked: Should we not return to these three by-products of solar energy?

Some environmentalists advocate the trimming of energy needs to what they were before the introduction of fossil fuels, but most advocates of these soft energies are looking for some way of reverting to them without lowering living standards.

Of the three energy sources, only water plays an important role in developed countries today. Whereas our ancestors could extract very little energy from their water and tidal mills, the development of turbines has opened up the potential of hydroelectric power. To this day no cheaper source of electricity has been found.

In many countries such as Nor-



Waiting for the wind are these blades of an experimental aerogenerator.

way, Sweden, Canada and Brazil, hydropower remains the main source of electricity generation. In the Third World the potential for hydropower remains largely unexploited. According to the 1974 World Energy Conference, the world's hydro potential is 2.26 million megawatts, but installed ca-

capacity totals only 307,000 mw. China is thought to have a hydro potential of 330,000 mw, the Soviet Union 269,000, the United States 186,000, Zaire 132,000, Canada 94,000 and Brazil 90,000. Yet even if all these resources were developed, hydropower could only meet around 15 percent of the world's

total energy needs compared to barely 2 percent today.

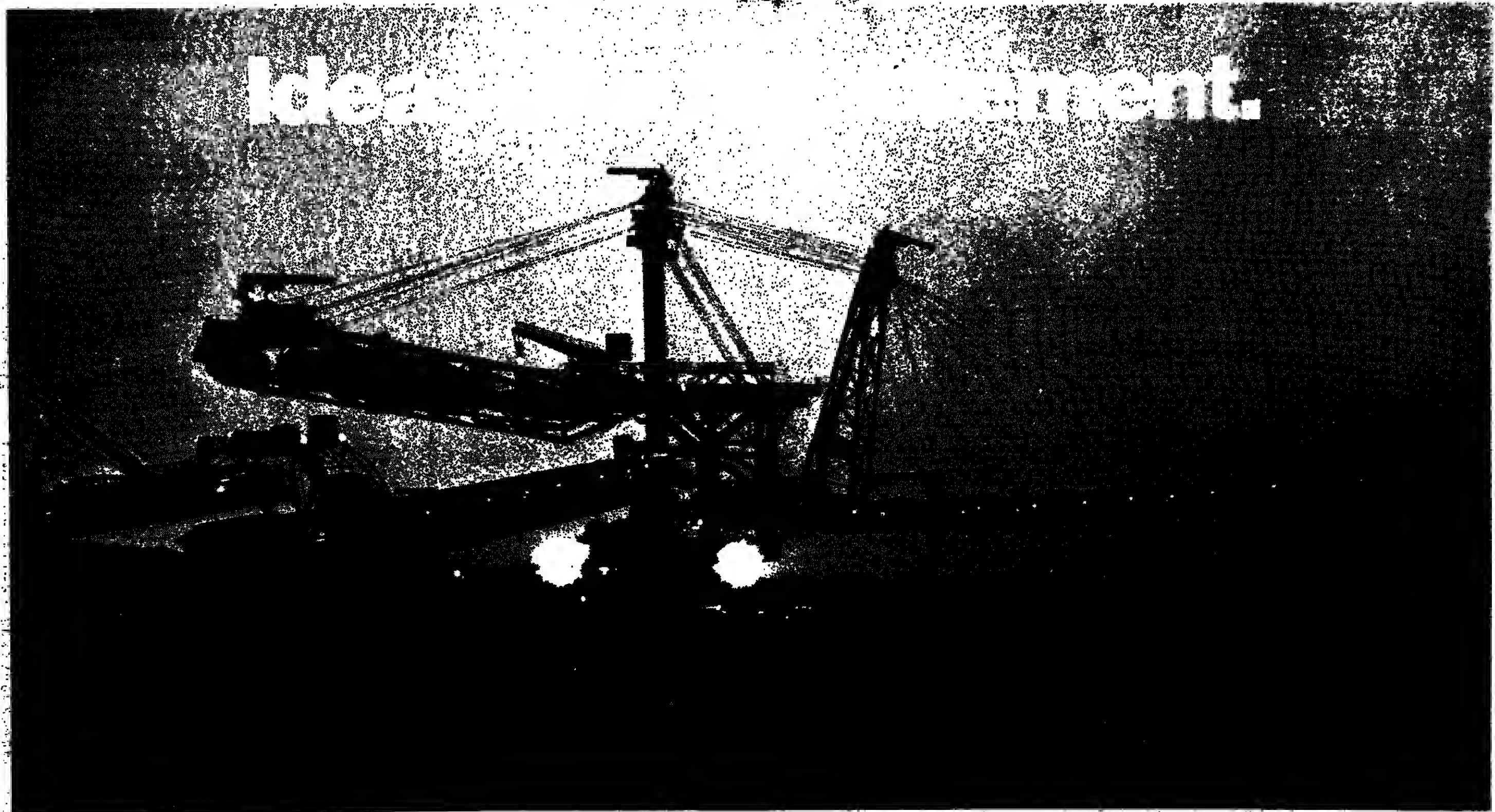
But there are reasons why the full potential is unlikely to be exploited. In developed countries the best sites have already been taken and further encroachments only spark off opposition from environ-

mentalists. Developing countries have enormous possibilities, but they can rarely afford the huge investments needed for major hydroelectric projects and may also be reluctant to interfere with existing navigation or fishing activities. With only limited local electricity demand and with the difficulties of transmitting electricity over long distances, hydropower is not economically viable in many of these remote areas.

The exploitation of water power through hydroelectric schemes is limited essentially by cost. Long-distance transmission of electricity remains a subject for research, but it is difficult to see how the efficiency of the turbine generators could be raised much above the 90 percent levels already attainable. Research work has therefore shifted to other less conventional sources of water power.

One idea is the use of tides. If the old water mills were to give way to hydroelectric schemes, why should not the old tidal mills be replaced by large tidal power stations. For more than 10 years the French have operated a 240-megawatt plant of this kind at La Rance, near St. Malo in the northwest of France.

About 30 sites suitable for tidal-power stations exist in the world. (Continued on Page 7)



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# Interview: 'We Need Growth . . . and Energy Creates Growth'

MANNHEIM, West Germany (IHT)—When the Hannover fair, one of the most important industrial trade fairs in the world, is held this month, it will inaugurate a program on energy systems with more than 300 lectures by specialists in the field.

The initiator and chairman of this program is Hans Freilaender, deputy member of the board of directors at the German subsidiary of Brown, Boveri & Cie., whose products extend from power plant equipment and household appliances to solar-heated homes.

As a representative of the energy industry, Mr. Freilaender was interviewed by Thomas C. Lucey of The International Herald Tribune.

Mr. Lucey—You recently quoted the 1975 figure for total energy investment in West Germany, some 15 billion marks (now worth \$7.5 billion), and pointed out that it was almost half the total figure for all investments by industry in this country. Does this ratio still hold true?

Mr. Freilaender—The 1976 figures are not yet available from the Federal Statistical Office in Wiesbaden, but according to the IFO economic institute, industrial associations and other sources, it is still about 50 percent of all investment or maybe slightly less.

Q—What do you expect for investment in 1977 and 1978?

A—The problem is that we have had a construction stoppage, not an official one but a practical one, for three years. This has stopped the building of all power plants in West Germany.

For example, BBC was working on a filter for a coal plant in Westphalia that would increase the pow-

er output while decreasing the harmful effects on the environment. However, an engineer brought a legal complaint against the project and it was upheld by a court in Münster that stopped all work at the site.

Q—What do you mean by an unofficial construction stop?

A—The specifications for building power plants are contained in an administrative rule giving technical specifications on air pollution. It is binding on the builders. But the administrative rules do not bind courts, who can make their decisions by other standards. So if someone protests about the building of a power plant and takes the matter to court, the decision need not be based on the standards that the builders were required to observe.

So power plants are not being built in West Germany. Work on the sites has stopped.

These contracts are very long-ranged. There is a large capital investment in machines and highly, very highly, qualified workers. When there is a construction stop, the capacity of the factories stops and the capacity of the workers stops. Things are running idle. Now we are in a situation where we must consider if we can keep this many qualified workers.

Q—How many people are affected?

A—In total, someone has worked out these figures: power plant workers alone, 40,000; primary suppliers, another 40,000; with all others, a total of 200,000. If no more power plants are built in the Federal Republic (of Germany), the effects would be more catastrophic than this. The Federal Re-

'One of the problems is that nuclear plants have been compared with the nuclear bomb, which is very destructive. A nuclear plant is not a bomb.'

bomb.'

public is now a country with the highest labor costs—second only to Sweden—and practically no raw materials. We can keep our industries only through high-quality and reasonably priced energy. If there is only expensive energy, it would considerably damage this country.

In the future, we will still need electricity, whether we are using wind or whatever to make it with. So we will need electrical power plants. The question remains, from what source.

Electricity is easy to use. It is easy to transport, available where it is needed without storing it and additional facilities are not needed. You don't have to burn anything. It's available by pressing a switch. It's clean and doesn't create dirt.

Q—Now Germany depends mostly on coal to make electricity, doesn't it?

A—Yes, almost 60 percent comes from coal and a little more than 7 percent from nuclear energy.

Q—How much longer can you rely on coal for electricity?

A—It is not how much coal we have, but how much of it is economically feasible to use. The use-

ful coal supply is essentially smaller than the actual coal supply.

Q—You noted recently that the need for primary energy in West Germany from 1980 to 1985 is expected to increase by 7 percent for each percentage point in general economic growth. At the same time, the use of electricity is increasing about two points higher than the real increase in the GNP and only in the most favorable circumstances can it slowly be reduced to the same growth rate. How do you explain this difference in growth rates between primary and secondary energy?

A—We are making more secondary energy with less primary energy. At the same time, the need for electricity is increasing through the trend to rationalization, which is replacing work by hands with work by electricity.

Q—You have said that the power plant capacity in this country must be increased by about 30,000 megawatts by 1985. Is this figure still up to date?

A—It is still current, but it will

probably not be reached in the 1980s.

Q—Has the race already been lost?

A—That is a very good question. Coal plants have comparatively shorter building time, so they may be able to fill the energy deficiencies in the 1980s. Nuclear plants require much longer, eight to ten years from the time of getting the first building permit till the electricity is in the grid. For a coal plant, that would take five to eight years.

There are now plans in Bonn and at the state level to build new coal plants. Permission for one has already been given and we figure that there will be some others. I don't know what percentage of the lack of energy they will be able to fill. That depends on the GNP growth rate in the 1980s and whether there will be a lack of energy before 1980 or not, which in turn will effect the growth rate until 1985.

We need growth for industry, for our obligations to the workers, to the old. We need growth for our international role and for our domestic obligations. Without growth, the financial performance by the Fed-

eral Republic would not be realized.

Growth creates energy and energy creates growth. Those who oppose building new power plants must accept that growth is not needed, with all that implies. The results would be overwhelming.

So, instead of having the needed 30,000 megawatts by 1985, we will have maybe 20,000 to 25,000 because of the construction stoppage. If permits were given for new nuclear plants this year, the plants would not be in use by 1985, and it was just reported that the permission for the reactor at Neupotz can no longer be expected for this year, but in 1979 at the earliest.

Q—Can the energy needs of the 1980s be filled without nuclear power plants?

A—That is hard to say.

Q—Do you feel you have the support of the political parties, especially since the two coalition partners in the government have been divided over this issue?

A—Both have said nuclear energy is essential, so nuclear energy is politically acceptable. Of course, there are other groups, such as the environmentalists and the courts, which sometimes reach different conclusions about nuclear power plants than the people in the field.

Q—Do you think more can be done about energy conservation?

A—For industry, saving energy has always been an accepted fact. Industry has always been forced to save energy because it had to make a profit, to fulfill contracts using as little energy as possible.

But I don't think the government should force people to save energy. It is possible to save secondary energy in the private area by increasing awareness of it. But not, as someone has said, by turning off electricity at the peak points of use. If the housewife can't cook at a certain time she will cook the same meal earlier or later.

It is not the function of government to create a shortage of things and then divide up the shortage. Government must protect available energy at bearable prices, and this cannot be done if it does not say yes to nuclear power. It cannot say no to power plants so that in a certain year there are shortages. This cannot be the goal of politics.

Q—But many people are still very concerned about the safety of nuclear power plants.

A—First of all, radiation from a plant is far under the normal amount of radiation in the atmosphere. The possible source of dan-



Hans Freilaender

ger is that men in the plant could lose control of the process—but that must be full loss of control and all safety measures fail. That means that no one would do the right thing to prevent the danger. That everything that could go wrong would go wrong and no one working in the plant would do anything about it.

And remember, in all the accidents up to now, no one outside a plant has been injured. The damage has been contained inside.

One of the problems is that nuclear plants have been compared with the nuclear bomb, which is very destructive. A nuclear plant is not a bomb.

Q—If West Germany must de-

pend on nuclear plants for its energy, where will it get the uranium?

A—There are a few sources in the Federal Republic, but certainly not enough. So we are dependent on foreign supplies.

Q—And face the risk that these supplies can be stopped at any time?

A—I think we will come to depend on the breeder reactors.

Q—And with them the risk that some people will say the Germans are making nuclear bombs and have hidden them. Do you think this country would be able to live with this kind of political pressure from, say, the Americans and the Russians?

A—I think we could live with it.

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# Interview: Society, Politics, Economy Will Shape Technology

WASHINGTON—Dr. Bruce Murray, who holds a Ph.D. in geology, is director of the Jet Propulsion Laboratory at the California Institute of Technology. Dr. Murray was a Guggenheim fellow and has won recognition for his work on the Mariner space program as well as a number of awards from the scientific community. He has published often on energy technology for professional journals. Here, Dr. Murray discusses the role of technology in energy with J.P. Smith for the IHT.



Bruce Murray

Mr. Smith—What role will technology play in resolving the problems posed by energy shortages in the years ahead?

Dr. Murray—The right way to look at technology is not necessarily what kind of devices are coming along, but rather what kind of economic and political factors loom on the horizon.

There are no easy answers—no technological quick fixes. A more valid question might well be, "What are the drivers for technological change?" There are, for example, several interesting drivers that will not only stimulate the development, but the absorption of new energy technologies as well.

Q—What are they?

A—First, and quite important is the growing consciousness that we face a shortage unless something is done.

Second, there is a recognition that very large-scale economic and political enterprises, typified by the dimensions of the international oil market as we know it today, may be reaching the limits of scale.

There are simply a lot of indications that the system is creaking. The economics of scale apply in theory, but in reality they face problems over the next 10 to 20 years. New energy technologies—such as solar or geothermal—will come on stream because of this.

Q—Are you saying that political factors and economic conditions will force the shape of technologies to a greater extent than most people expect?

A—Yes, in a sense. New technologies and refinements of other energy systems which require global or multinational cooperation for their development and utilization may face increasing costs. These higher costs, in turn, become drivers for regional, smaller-scale solutions.

and nuclear with solar-electric sources or perhaps others. We will either go to a totally centralized electrification grid, much like what we have in the United States today, or a new kind of electric grid that would mix different components. In the end, it depends on the rate at which solar electrification is introduced.

Q—How soon do you expect solar-electric devices, or, say, photovoltaic cells, to come out of the laboratory and into the marketplace?

A—There are barriers to utilization of solar energy, and I think it is important to understand them. One genuine barrier is the investment that has already been made in pipelines, electrical transmission systems, and large-scale power plants. If we go another 20 or 30 years along the direction of ever-increasing generation of electricity from fossil fuels, we may be in an irreversible posture. There may be a point of no return when the capital outlays required to introduce a really different energy technology like solar electric simply exceed what the then more-brittle economy can muster. We certainly are not there yet, but it is difficult to set time scales. Changing into a large-scale use of solar energy is going to take a lot of time. I am not optimistic that change will occur very rapidly unless we can provide positive incentives to various groups and factions, to help them evolve their ways of doing things.

Q—Earlier you said that there is a growing recognition of economic and political limits that could infringe developing technological solutions to our energy-supply problems. Are you talking about nuclear power?

A—Yes. Nuclear power is certainly an example of it. Analysis completed 10 to 15 years ago indicated that nuclear energy would be our best and least expensive source of energy. Obviously, some of these assumptions have broken down because of problems that have surfaced through the political process and elsewhere, such as siting and nonproliferation concerns. The result is that nuclear power today is being introduced at a much slower rate than was forecast, and costs again are much higher than were anticipated.

Q—How can these problems be overcome, what contribution can

technology make to overcoming these political limitations on nuclear development?

A—Waste disposal is a critical question that affects not only siting but the question of proliferating nuclear weapons. It is imperative, I believe, that we develop nuclear waste-disposal systems that can be demonstrated in an open and pub-

lic manner in order to garner public support and acceptance for nuclear technology. Obviously, some countries will respond to these questions at a different rate. The United States now, for example, is moving away from developing nuclear power in a sense, while others, in my view, are embarking on a widespread nuclear development with-

out resolving the waste-disposal problem.

Nuclear technology has come along as intended, but the problem is that the relationship between technology and society has not been anticipated. There is still a nagging credibility gap between the people and industries in countries where it is deployed. Unless this

gap can be overcome in a positive sense—not just fear of running out of energy—the nuclear business will never reach the level of promise anticipated by its innovators.

Q—Are you saying, then, that there is no single technological solution to our energy problems, that we can expect many small ones?

A—Unfortunately, there is no single answer. What will happen—in other words the kinds of technology we develop—will reflect the preferences, expressed one way or another, of the people of various countries regarding their environment, their health, their material standard of living, and their attitudes towards their descendants.

## Wind, Water, Wood: Searching for a Better Harness

(Continued from Page 5)

with an estimated energy potential of as much as 64,000 megawatts. Among the most promising are the Severn estuary in Britain and the Bay of Fundy in Canada.

But tidal-power stations are very costly, the varying head of water reduces efficiency to less than 25 percent and nobody knows the environmental implications of interfering with tidal flows. Although serious thought is being given to a Bay of Fundy development, it is significant that the French are not going ahead with the larger tidal plant they had planned off Mont St. Michel.

The exploitation of wave power is considered more promising, especially by the British and the Japanese. Under a plan backed by the International Energy Agency, Japan is hoping to obtain electricity from turbines installed in a buoy out at sea. In this system, the turbines are not driven directly by the waves, but by air pressures created by the waves.

The British government is currently examining for hydraulic systems the Sellar Duck, the Contouring Rafts, the Russell Rectifier and the Air Pressure Rins Buoy. Under all these systems the force of the waves is converted by hydraulic and mechanical means in such a way that it can power an electricity-generating turbine. The Sellar Duck technique is currently being tested at Loch Ness in Scotland, while Hovercraft inventor Sir Christopher Cockerell is experimenting with the Contouring Rafts system in the Solent off the Isle of Wight.

Britain's Department of Energy believes that as much as 30,000 megawatts, equivalent to half of

Britain's current electricity consumption, could be met by such wave generators if stretched over 600 miles. But it is easy to imagine the problems of keeping the devices in place and the hazards they might represent to shipping.

Although offshore oil technology may eventually make it possible to place such generators out at sea, most existing proposals are concerned essentially with coastal installations. Similar experiments are also being considered regarding harnessing the power of ocean currents on the East Coast of the United States, but this would probably be even more difficult and expensive.

### Fascination

What has fascinated French and U.S. researchers, however, has been the possibility of extracting energy from the temperature differentials in tropical seas. With surface temperatures at about 25 degrees Celsius and waters 1,000 meters deep only 5 degrees Celsius, it should be possible to use the difference to drive a heat engine.

The French were the first to show an interest in exploiting what are called thermal ocean gradients when they set up a pilot plan off the Ivory Coast in 1951. However, the work was abandoned after independence.

American engineers suggest that a plant should be installed in the Gulf of Mexico. But the small temperature differences would give such plants very low efficiencies and it is not certain whether the idea is financially or technically feasible on a commercial scale. The U.S. government is nonetheless building a one-megawatt demonstration model.

The ease with which wind can be

used to provide mechanical energy for small communities has made it second only to solar power as an alternative energy source for remote areas, but the very output of most windmills or aerogenerators make it unlikely that wind will ever make any appreciable contribution to the world's energy needs.

The advantage of wind as an energy source is that its power is greatest in the winter months in areas which do not benefit from much sunshine. This is why it is seen as a complement to solar energy. With its ability to produce electricity directly rather than through steam as in the case of solar energy, its efficiency is around 35 percent compared to 15 percent. It can be used both as a centralized source of electricity and as a decentralized one.

### Drawbacks

But it also suffers from very serious drawbacks. It can only be found in certain areas, its strength is irregular and the electricity produced cannot easily be stored. Small units can provide very little electricity, while with larger ones the rotors are liable to break. Windmills are noisy, they may interfere with television reception and if used in the size or quantity required to make any significant energy contribution they would be unsightly.

But several countries are taking wind power very seriously, notably Sweden, Denmark, West Germany and the United States. Denmark has just completed a two-megawatt windmill at Tvind, the world's largest unit. The biggest previous unit was a 1.25-megawatt U.S. machine abandoned soon after it was put into operation after World War II. The United States, Sweden and

West Germany are all planning three-megawatt models. In a report published by Britain's Department of Energy it is claimed that megawatt units are now competitive with conventional power plants in mean wind speeds of over 14.5 knots.

Most countries are still sticking to the conventional horizontal Dutch windmill design. Their research efforts are concentrated on finding more reliable materials for the rotor blades. Thanks to experience from the aircraft industry they are developing new materials in steel and fiberglass.

The Canadians, followed by the Dutch, are working on a vertical windmill called the "Darrieus rotor." The advantage of this technique is that the same power can be obtained with a simpler and lighter machine, but, according to Dr. Dieter Renz of the International Energy Agency, it is not a self-starting windmill and requires high velocity winds.

Wind power, like solar energy, is ideally suited to Third World countries. It offers the possibility of mechanical energy for water pumping, or corn grinding as well as electricity in areas which are not connected to a national electricity grid. Unfortunately, wind conditions are often not suitable in many developing countries that have little wind most of the year and monsoons the rest of the time.

### Wood

In developed countries with windy coastlines, wind power could become a reality, but the presence of hundreds of aerogenerators is only likely to be acceptable in the most remote areas.

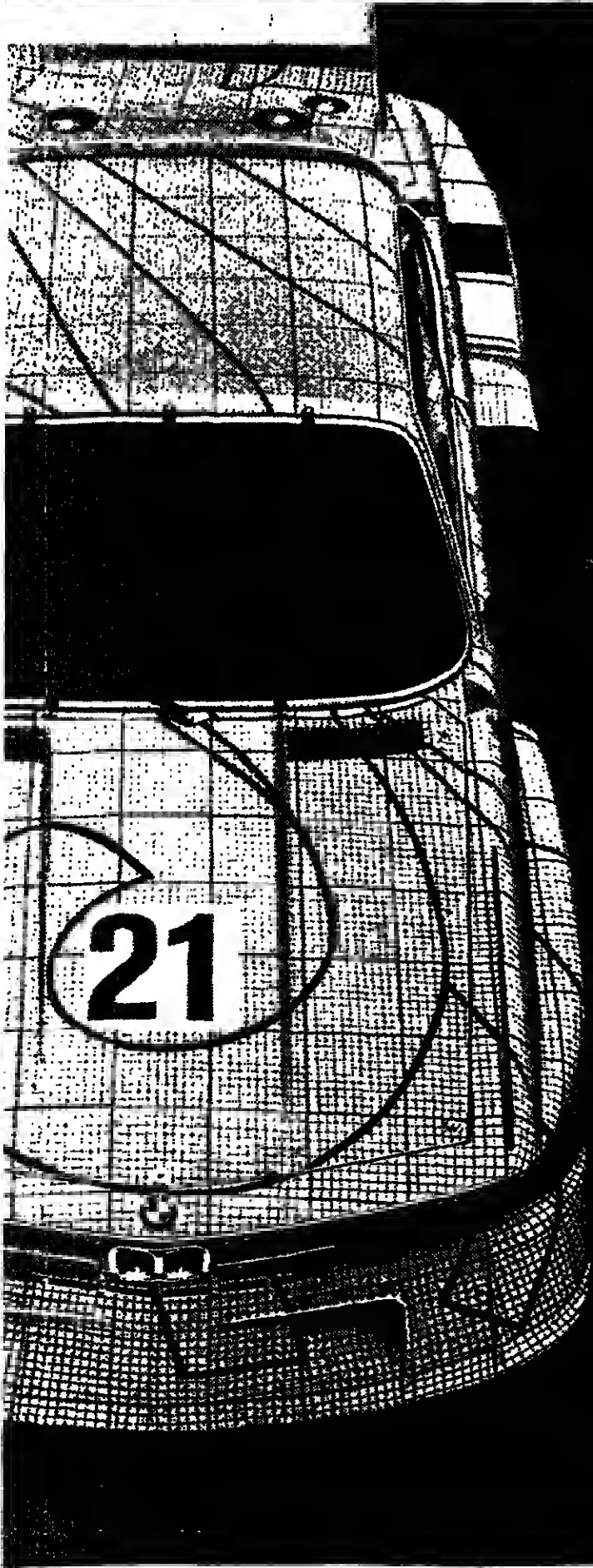
Until the 18th century, wood or charcoal was the only heating fuel used by man. Even today most de-

veloping countries rely on wood for cooking and heating. Often the use of such fuel is not even recorded in statistics because it is collected by the users themselves. But wood is only one example of how man can trap solar energy from plant life and organic waste as a whole.

The useful energy contained in wood, plants and organic waste is the result of photosynthesis. Under this biomass process, plants absorb some of the sun's energy as they build up their carbohydrates. Scientists have realized that man might do better allowing plants to collect solar energy for him rather than go to the trouble himself.

Man has merely used whatever biomass was available to him. Farmers might burn their straw, local authorities have produced gas from a town's waste products, Indian peasants burn cow dung for cooking. But with the growth of interest in new energy resources, countries like Sweden and the United States and Canada are trying to develop fast-growing trees. Brazil is producing methanol from sugar cane and manioc, and China and India are turning cow dung into gas for cooking purposes. Experiments are being carried out into growing "forests" of algae.

But the possibilities of biomass are limited. Photosynthesis is inefficient, with plants absorbing only 2 to 3 percent of the sun's energy. The space required for growing plants or trees must compete with land for food production, and harvesting is generally more trouble than it is worth. In developing countries, where labor is cheap and there is plenty of poor-quality land available, biomass might have a role to play—but if food can be grown, it will surely be the main priority in these countries. —M.P.



## Competition improves the breed.

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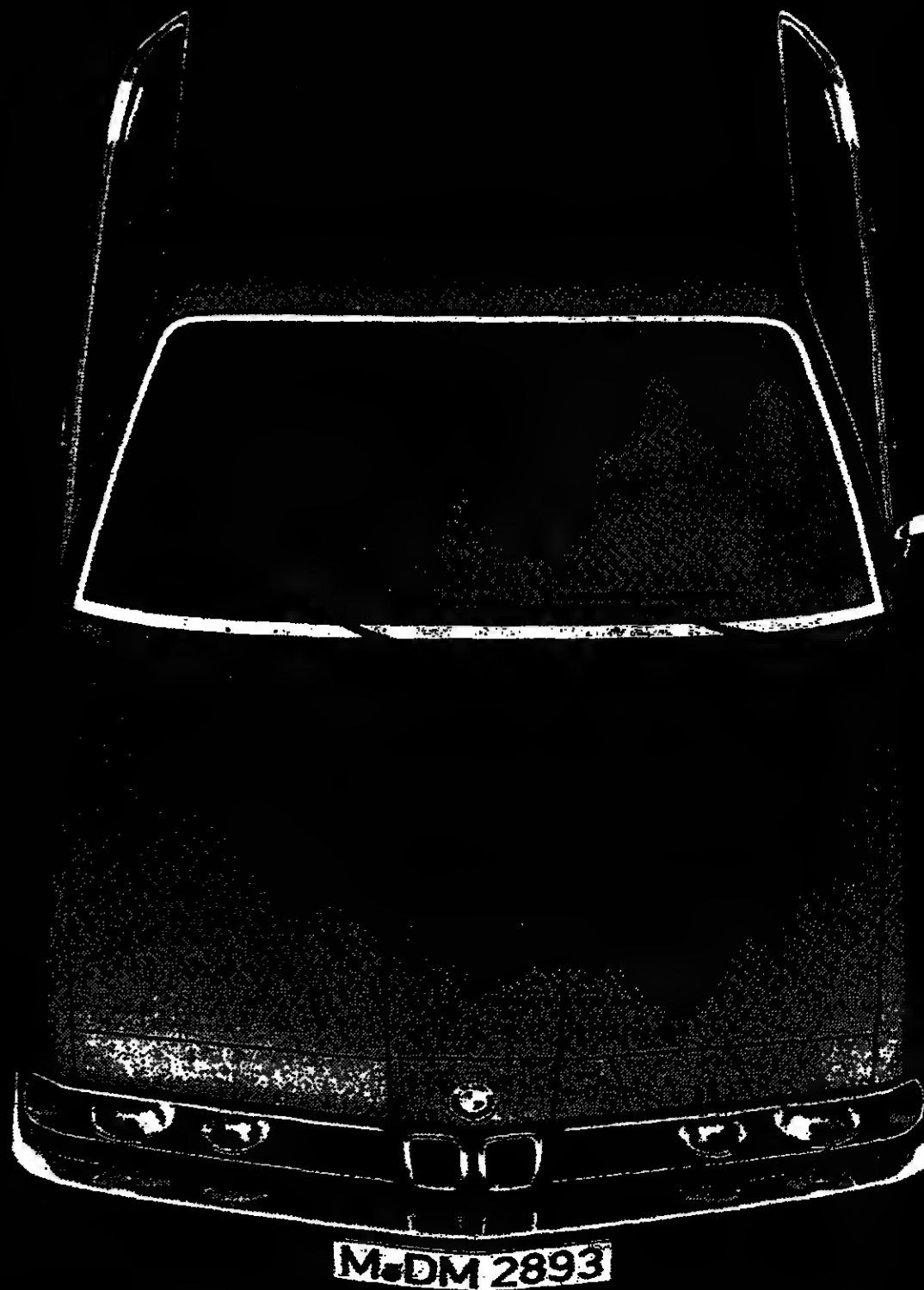
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# Soviet Union: Fuel Exports Pay for Progress

By Douglas Sutton

MOSCOW (IHT)—The subject of the Soviet Union's energy production capacities has in the past year been debated in various Western circles—with predictably various opinions.

A pessimistic outlook, such as that of the Central Intelligence Agency last year, predicts that despite its vast resources, the Soviet Union may become an importer of oil in the early 1980s. More optimistic observers believe that Soviet production of energy fuels will continue to keep pace with both its own energy needs as well as its export targets, at least through the next decade.

Regardless of which view turns out to be correct, two things seem at this point to be certain:

- As in the past, the Soviet Union will, to a large extent, import sophisticated Western technology to supplement its energy resources.
- The Soviets will continue to use the hard currency it earns from fuel exports to the West to pay for imports of Western energy technologies.

## Other Sources

While the backbone of Soviet energy production will continue for some time to be oil, natural gas and coal, the Soviets are nonetheless doing serious research and development in a number of other energy areas. These include fusion reactors, solar and wind power plants, magnetohydrodynamic (MHD) and cryogenic generators and geothermal power.

Moreover, due to the sometimes unique—and often difficult—geographic conditions of climate and distance, Soviet scientists are working on further improvements on drilling, mining and transportation know-how.

Firsthand analysis of the current state of Soviet energy production technology is rare. Few Western industry specialists are allowed to visit oil, gas and coal mining sites. Those who do succeed in making on-site inspections are usually representatives of Western firms hoping to sell equipment to the Soviets.

One such company representative, a sales engineer with a major U.S. oil equipment manufacturer, said, "From what I've observed, the Soviets are anywhere from 10 years behind in drilling technology to 15

to 20 years behind in offshore know-how."

He added: "There's no doubt that some of the purchased Western equipment is not for use in the field but rather is taken apart in some laboratory to try to copy the technology that has taken us 25 years to develop."

One reason the Soviet Union can spend a lot for Western equipment is that it earns a lot in exports of oil and natural gas to the West. In 1976, for example, energy fuels exported to the West brought in revenues of an estimated \$5 billion.

That the Soviets are interested in more Western oil and gas equipment, and that Western firms are more than willing to sell to the Russians, is beyond doubt. Last fall, for example, more than 130 U.S. companies—practically a "Who's Who" of the Texas, Oklahoma and California oil and gas drilling industry—staged a nine-day exhibition in Moscow in hopes of winning future multi-million dollar orders.

Several of those companies just recently landed contracts worth more than \$20 million for drill rigs and medium-pressure sour and sweet gas well equipment, while others continue negotiations for a variety of geophysical surveying, drilling and offshore equipment and technology.

However, it would be misleading to say that Soviet engineers have not come up with their own developments in the oil and gas equipment field. One fairly sophisticated piece of equipment that the Soviets have developed is, for example, the turbodrill.

Unlike rotary drills, in which the entire pipe shafting is rotated from above ground during drilling, the turbodrill is located at the digging end. It drives only the drill bits while the piping above remains stationary.

Turbodrilling accounts for at least three-quarters of all Soviet oil and gas drilling. Engineers are working to improve the turbodrill's capabilities in heavy muds and high temperatures while also increasing the depths—beyond 15,000 feet—in which turbodrills can operate efficiently.

Soviet development efforts are also directed toward pipelines. The current Five-Year Plan calls for a total of 85,000 miles of gas lines to be functional by 1980, an increase

of more than 20,000 miles from 1975.

New technologies are being developed to try to overcome the problems posed by the great distances and the severe geographic and climatic conditions. In the experimental stage is a method for accelerating natural gas to speed up deliveries from Siberia to the European part of the Soviet Union. The method involves freezing and compressing natural gas into a snow-like substance just 1/400 of the original mass, and then putting it into containers which can be whisked through compressed 2-1/4-meter wide synthetic pipelines at speeds of 150 mph.

## Pipeliner

Soviet engineers have also begun using a method for anchoring pipelines in water-filled areas in the Tyumen Province in western Siberia. Instead of using heavy iron or reinforced concrete collars to hold pipelines in place, the Soviets have come up with much lighter anchors which can be shot into the ground in harpoon style.

Another new development is the inspection of oil pipelines buried in remote regions using an infrared detector—from an airplane flying at 3,500 feet. The heat-sensitive detector can locate pipelines, evaluate the heat of the crude oil inside and provide other data for repair work.

While the Soviets have been importing Western equipment to conduct seismographic surveys of po-

**'From what I've observed, the Soviets are anywhere from 10 years behind in drilling technology to 15 to 20 years behind in offshore know-how.'**

tential oil and gas fields, experimental work is also being done to develop new methods. One was reported by the Ukrainian Geological Institute in L'viv, in which a laser-based method of using holograms was being tested to convert conventional seismic data into graphic form. If the technique proves successful, it could facilitate the work of some 40 computer centers now being used to analyze seismic data.

Despite the fact that the Soviet Union, particularly in various regions in Siberia, possesses huge oil and natural gas resources, Soviet planners have to consider the country's long-term energy needs and are busy looking into and developing other sources of energy.

One Soviet scientist, Yuri D. Kononov, said that "the share of nuclear energy will increase over the long-term, while hydroelectric power output should hold its present share, increasing at about the same rate as overall energy output increases."

Mr. Kononov is currently at an

East-West institute near Vienna called the International Institute for Applied Systems Analysis (IIASA). With other scientists, he is working on what he calls "impact models"—computer studies of the potential impact on national economies of investment of materials and manpower in developing future energy supplies.

He said that the Soviet Union, unlike the United States, will probably not go into large-scale development of solar power, "due to our geographic position and because we have many other natural resources." Western experts estimate that as much as one-fifth of all new installed generating capacity in the Soviet Union during the current Five-Year Plan will be accounted for by nuclear power.

Current research and development is being concentrated on a fusion reactor which produces electricity and also nuclear fuel for conventional fission reactors. The work is going on at the Kurchatov

Institute with the Tokamak-10, an experimental fusion device in which a power output from plasma confined in a magnetic field has reached 450,000-600,000 amperes for about a half second.

Together with the Electric Power Research Institute of Palo Alto, Calif., the Kurchatov Institute will begin work in the early 1980s with a Tokamak-20 test reactor. It will contain deuterium-tritium plasma at 50 million degrees Celsius for more than one second, according to Eastwest Markets, a Chase Manhattan Bank publication on East-West trade.

The newsletter said that U.S. scientists are interested in the Tokamak-20 because it could offer a possible alternative to fast-breeder reactors.

## MHD

Another joint U.S.-Soviet project is in the development of magnetohydrodynamic (MHD) power generators. They may be able to convert fuel into electric power at 50-percent efficiency, compared to the 30-40-percent efficiency of conventional generators.

Testing is scheduled to begin this year at the Soviet High Temperature Institute near Moscow with a 4-Tesla superconducting magnet delivered last summer by the Argonne National Laboratory in Illinois. The 60-ton magnet will be used in experiments with a Soviet-built natural gas-powered 300-megawatt MHD pilot plant.

Under a reciprocal arrangement, the Soviets will later take part in tests at an end MHD research facility to be built in Montana.

Also in the field of generators, Soviet scientists have been experimenting with a super-cold cryogenic generator at the Research Institute for Electrical Equipment in Leningrad. The generator's rotor is a cryostat made of niobium titanium alloy that is continuously fed by liquid helium which keeps temperatures at near absolute zero, thus providing high conductivity and fuel conversion efficiency. The generator has an output of 1,000 kilowatts, but Soviet scientists believe that the cryogenic technology can lead to generators producing 2,500-3,000 megawatts or more, with at least 90-percent efficiency.

M.P.

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## Consumer Countries Pool Research

(Continued from Page 1)

\$200 million. Since the first agreements signed at the end of 1975, the agency now tallies nine projects in coal, seven in energy conservation, one in nuclear safety, one in geothermal, six in solar, two in wind, three in fusion and one in hydrogen production. The agency has no projects in the oil field.

The areas that receive the most funds from governments are coal, fusion, conservation and hydrogen, with the United States, United Kingdom, West Germany and Sweden among the most generous contributors. Among the more spectacular projects are the fluidized bed combustion pilot being built at Grimthorpe in Britain, the planned

cooperation between the United States and West Germany in the gasification of coal, the decision to build two 500-kilowatt solar-powered plants in Spain, the costly fusion research being carried out in the United States and West Germany and plans to manufacture hydrogen with the waste heat of nuclear reactors at Ispra.

## Participation

Given the choice, most governments prefer to carry out research on a national rather than an international scale. However, the existence of organizations like the EEC and the IEA allows countries to participate in a wide range of re-

search activities otherwise not available to them.

Under the IEA, governments or companies may acquire know-how and preferential royalty treatment on techniques being developed in other countries.

At the EEC the research efforts of community companies can be encouraged and the technological bottlenecks that particularly affect the Nine can be removed.

In the long run, however, funds required for the development of conventional and new energy sources—the \$250 million or more currently being spent each year within the framework of these two organizations—is but a drop in the ocean.

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# West Germany: Resource Poor, But a Leader in Technology

By Thomas C. Lucey

FRANKFURT (IHT)—While West Germany may be poor in all its energy resources except coal, it is rich in energy technology. This includes technology for fossil fuels and nuclear energy as well as for fuels whose time has not yet come.

Laser enrichment, a shortcut to highly enriched uranium, is being intensely researched in the United States, France, Great Britain and Israel. German work in this area started in 1971, with basic research at the Battelle Institute in Frankfurt. Uranit, Juelich, a company in uranium isotope separation, has supported this work with government funds and, since 1973, has given contracts to more research organizations.

Uranit, which is owned by companies belonging to two giants in the German energy field, VEB and Rheinisch-Westfälisches Elektrizitätswerk (RWE), is a member of Uranco/Entec, a German, British and Dutch joint effort to collaborate in uranium enrichment by gas centrifuge.

Last month, Uranit announced its selection of Gronau, near the Dutch border, as the site for a 1-billion-deutsch-mark (now worth \$500 million) gas centrifuge uranium enrichment plant. The Gronau plant is expected to be ready in the early 1980s, supplying enriched uranium to about eight nuclear plants of the Biblis type.

Kraftwerk Union (KWU), wholly owned by Siemens and probably this country's internationally best-known builder of nuclear plants (including the 2,500-megawatt one at Biblis, south of Frankfurt), is also said to be engaged in research on laser enrichment.

## 1,000 Degrees

The German subsidiary of the Swiss company, Brown, Boveri and Cie., which supplied what it called "the world's biggest transformer" for the D.C. Cook 2 nuclear plant in the United States, includes among its products essential components for technical security in high-temperature reactors.

At the Nuclear Research Facility in Juelich, the company conducts high-temperature helium tests of up to 1,000 degrees Celsius, with a turbine equivalent in size to a 300-megawatt helium turbine. The Brown, Boveri laboratory there tests the behavior of materials under permanent high temperatures.

Coal gasification is synonymous with Lurgi, although the Frankfurt-based company has competition from a Krupp subsidiary and other companies as well as from expected processes being developed by Texaco and Shell.

"The market is developing for coal gas," said Dietrich Natus of Lurgi, "primarily in the United States and secondarily in Europe, as the availability of natural gas declines."

Low-priced crude oil and rising coal prices in the 1960s caused most plants for coal gas to close.

Industry will be willing to pay the higher price for coal gas rather than risk interruptions or rationing of their energy supply, Mr. Natus explained. And in places like Australia, where crude oil prices are

raised by long tanker routes from the sources, coal gas is even more attractive.

Lurgi has expanded the range of coal sizes, from a spectrum of 6 to 20 mm to 2 to 30 mm and it can use caking coal. During World War II, Lurgi was able to produce 5 million tons of fuel from lignite. (The first work on the process began in 1930.)

## Gasifier

The latest model gasifier is the Mark IV, named after its four-meter diameter. By comparison, gasifiers built by Lurgi in South Africa 20 years ago had a diameter of 3.7 meters, only slightly narrower. (In the gasifier, the solid fuel is put under pressure of 145 to 435 pounds per square inch, using an oxygen-steam mixture. The clean gas that emerges from the process has a high calorific value of about 430 to 490 British thermal units

(BTU) because of the use of oxygen rather than air in the gasifier.)

Despite its long history and wide use, the process does not yet pay its own way. "We are still putting in more than we take out," says Mr. Natus.

In the field of gas produced in oil drilling, projects include a platform-top power plant in the North Sea, planned by Nordwestdeutsche Kraft (NWK), Hamburg, to utilize the gas that has up to now been lost. NWK expects to produce 350 to 400 megawatts with gas turbines and has financial support from the European Economic Community and the West German government.

In connection with a Japanese company, DEMAG is supplying a re-injection process for Kuwait so that the propane gas that is forced to the surface by the rising oil is pumped back to bring more oil to the surface.

Germany is also active in seeking

a new technology to use alternate fuels.

The "fuel of the future" at Volkswagen is methanol. In a test program, 45 vehicles—among them the VW Golf, VW bus and Audi 100—were driven around Germany on a mixture of 15 percent methanol and 85 percent regular gasoline. In March and February, 1976, the test fleet drove with pure methanol and the methanol-gas mixture in the Arcde Circle.

## Pure Methanol

Using pure methanol on a regular basis is the company's goal, and this project is now said to be in its last step.

VW is also interested in using another alcohol as car fuel—ethanol. It can be made from a number of organic substances, including vegetables.

Daimler-Benz (Mercedes) has been conducting extensive research

into alternative fuels for many years. It has found that "hydrogen offers particularly interesting possibilities since the combination of spark-ignition engines and the hydride storage units does not present great problems and because pollutant emission of hydrogen engines is particularly low."

The company is testing a mini-bus built on a van chassis with a 60-horsepower engine. On a full tank it can go for about 120 miles. Efforts are being made to double this distance.

Mercedes would like to be able to run a test fleet of hydrogen-powered buses for the West Berlin public transportation authorities.

"The further development of hydrogen technology could bring about the eventual changeover from crude oil to hydrogen," the company said.

Last year, Motoren-Werke Mannheim (MWM), an outgrowth

of the stationary-engines department of auto inventor Carl Benz's company, turned out its first diesel engine for a thermal pump, to be installed in a 44-bed hotel in the Odenwald area. The diesel-compressor set extracts heat from the environment as well as from the engine itself, the gas exhaust and the radiated heat.

MWM says this method utilizes the hotel's waste water and used air and reduces the amount of oil needed to heat the hotel by 75 percent. The hotel will use an electric-thermal pump, to produce a maximum heating requirement of 1.7 million kilocalories.

## Hot-Dry Rocks

What is believed to be the first attempt in Europe to use the hot-dry-rock process to tap energy is being made in Urach, south of Stuttgart. As boring reached the

2,682-meter depth last month, it was still not known what the results would be. Geologists had expected to reach 110 degrees Celsius at 2,400 meters and use that warmth for local heating. (Experiments in Los Alamos, Calif., failed to find water at sufficiently high temperatures.)

The hot-dry-rock process involves injecting water into a widely extended system of small fissures in plutonic rock. The hot rocks heat the water, which is then brought to the surface through a second drill hole. To make the project pay, the heat must be able to be distributed as evenly as possible over several square miles.

The oil crisis caused the West German Ministry for Research and Technology to announce that it considered "the permanent primary energies of the sun and wind as having great importance" and to finance about 50 research and de-

velopment projects in the following years. The German Society for Sun Energy in Munich reports about 5,000 sun-energy facilities were built in this country by the end of last year—collecting a total of 30 to 35 megawatts, an increase of 20 times those available in 1976. For this year, according to the society, the total could reach 10,000 or 15,000.

Most of the facilities in use are for heating water, buildings and swimming pools.

At a conference of the Solar Energy Working Group (ASE) in Essen last year, information was exchanged on projects in this field undertaken or backed by some of the best-known companies in this country—Dortner, Hoechst, AEG-Teldec, MAN (Maschinenfabrik-Augsburg-Nürnberg), Philips, Brown, Boveri & Cie., Messerschmitt-Boelkow-Blohm and Bosch.

# France: Looking From Nuclear to Other Potential Sources

By Vanya Walker-Leigh

PARIS (IHT)—Following the 1974 decision to sharply reduce its 75 percent dependence on imported energy supplies, especially oil, France committed itself to Western Europe's most ambitious nuclear program.

But with the delays in nuclear construction schedules, other energy sources will be getting increased attention. In 1975, the government decided that nuclear energy should supply 60 million tons of oil equivalent (MTOE) out of a total estimated consumption for 1985 of 240 MTOE—involving a ten-fold increase in nuclear capacity.

A 13-MTOE shortfall is now officially foreseen for nuclear electricity in that year. Delays in finishing Westinghouse-licensed Pressurized Water Reactors (PWRs)—being ordered at the rate of 5,000 megawatts a year—are attributed by the state-owned Electricite de France (EDF) to technical reasons, the need to incorporate increasing security features and some difficulty in finding sites, often due to local grass-roots opposition.

But while there have been rumors that the French government has secretly contemplated phasing out its nuclear program, the recent nomination of the former head of the French Commissariat à l'Energie Atomique (CEA), Andre Giraud, as the new industry minister, would seem to contradict them.

However, Paul Mentre, the government's delegate-general for energy, states that the imminent report of a long-term forecasting group may come up with lowered estimates of future electricity demand—implicitly meeting ecologists' criticisms that previous forecasts were not based on real needs.

Also, he adds that increasing costs of nuclear construction (up 160 percent since 1973) mean "we may be more cautious in substituting nuclear for fuel-based stations in the future." Electricity rates, he says, will have to be considerably increased and other financial measures taken to reduce the EDF's increasing debt burden (now 31.4 bil-

lion francs, of which 14 billion francs are in Euroloans).

## Slammed

The 10-billion-franc-a-year cost of France's nuclear program has been privately criticized by Finance Ministry officials and publicly slammed by the National Assembly's Finance Commission. There is also criticism that nuclear gets 1.8 billion francs from the government's total energy research-and-development budget of 2.3 billion francs.

Other problems also loom over France's nuclear plans.

The outlook for long-term uranium supplies is precarious, according to a statement reportedly made by the foreign minister to last December's meeting of the Council on Foreign Nuclear Policy. By 1985, he is said to have warned, France will only produce 20 percent of its uranium needs (compared to 50 percent today) while Canada, the United States and Australia could well put tough conditions on future deliveries—in the context of the world uranium shortage forecast by OECD by then—and efforts to buy large quantities from South Africa would spark major problems with Niger and Gabon, where French state and private interests control uranium mines.

According to Mr. Mentre, more aid can also be expected for the 500-million franc research program on deep-sea drilling run by the French Petroleum Institute and two state-owned companies. A five-year research program on enhanced recovery techniques, costing 1.5 billion francs, will soon be launched, he added.

With domestic gas production at Laq (7 MTOE) declining from 1982, French imports of natural gas will continue to increase strongly under contracts concluded with Algeria, Iran, the Soviet Union, Norway, the Netherlands and, in prospect, with Nigeria.

## Solar

Following the establishment of the Solar Energy Commissariat this

spring, solar energy will be strongly developed, although Mr. Mentre doubts that it can meet more than 5 percent of French energy needs by the year 2000.

Not only EDF and CEA, but also the major oil firms are working on solar-energy technology, together with a group of France's leading industrial firms. Two small solar power stations are being built at present, with a French consortium participating in a European plant

being built in Sicily. Mr. Mentre foresees a possible breakthrough that could reduce production costs of photovoltaic cells in a few years and bring about a marked increase in output of solar heaters, capteurs and heat pumps.

France's well-developed network of solar cooperation agreements with Third-World countries will also be extended.

Geothermal energy will be promoted by the newly established

public company, Geochale, aimed at equipping some 300,000 to 500,000 homes by 1985, though its contribution to energy needs is seen as marginal.

The New Energies Delegation, overseeing solar and geothermal activities since 1975, sees little prospect for developing wind and wave power in France.

Energy conservation is expected

to play an increasing role, however. Of the 13 MTOE "saved" in 1977, 10 million of these were saved by private households. To meet 1985 energy-conservation targets, annual investments must run at 2 billion francs a year, compared to 2 billion in 1977, says the head of France's Energy Conservation Agency, Jean Syrota. Although the agency has promoted legislation on subsidies and incentives, funded over 130 demonstration projects and con-

cluded 40 energy-saving agreements with industrial federations, Mr. Syrota sees the need for new financial mechanisms that would encourage industry to invest in energy-conservation technologies. The agency is credited with persuading the government to halt the spread of all-electric homes promoted by EDF. But Mr. Syrota warns that a major rethinking of energy uses and of real energy needs must take place soon.

# Chinese Export Petroleum for Foreign Exchange

TOKYO (IHT)—If at the turn of the century oil for the lamps of China helped fatten the coffers of Standard Oil, today it is Chinese petroleum exports that have become a key source of foreign exchange for the new Peking leadership in a bid to realize its grandiose plan to create a "modern nation" by the year 2000.

For this purpose, a fuel-and-power directorate has been set up in Peking's State Council to build China into a strong power through the use of its oil and coal resources, both for domestic use and for export.

Heading this top-ranking organ, named the State Economic Commission, is Kang Shih-en, formerly minister of petroleum and chemical industries.

The importance that Peking attaches to its oil resources is further reflected in the creation of a separate Ministry of Petroleum Industries headed by Sung Chen-ming, formerly chief administrator at the pioneering oil field in Tachung in the northern Heilongjiang province.

Mr. Sung, one of Mr. Kang's former deputies, will be in charge of developing and exploiting 10 oil and gas fields that are part of 120 large-scale projects designed to fuel China's new industrial "great leap forward."

These projects, disclosed by Communist party Chairman Hua Kuo-feng in a 3-and-a-half-hour report to the National People's Congress held in February, include 10 iron and steel complexes, 30 power stations, six trunk railways and five

harbors. The target for their completion is 1985.

For their realization, China will have to earn foreign exchange to pay for the imported plants and the technologies it needs. Oil and coal exports are seen as figuring prominently in meeting this requirement.

## Guesses

Foreign estimates of China's recoverable fossil-fuel reserves are at best educated guesses. As for oil, estimates range from the 77-to-90 billion-barrel appraisal of the Japan External Trade Organization to an estimated 39 billion barrels made by the U.S. Central Intelligence Agency, to 20 billion barrels according to the American Petroleum Institute. With 20 billion barrels China's oil deposits would be 9th in the world, while with 39 billion barrels it would be neck and neck with the Soviet Union.

An independent American expert with close Peking contacts puts China's recoverable on-shore oil reserves at 45 billion barrels with additional offshore reserves at an estimated 30 to 110 billion barrels.

On the other hand, Chinese Vice-Premier Teng Hsiao-ping said last September that the amount of his country's oil reserves was estimated at 400 billion barrels. Chinese sources have claimed that petroleum deposits have been located from Sinkiang province in the west to Pohai Bay in the east and from Heilongjiang province in the north to the South China Sea.

Kang Shih-en, the newly appointed energy czar, has announced his objective to catch up

with and overtake the United States in oil exploration. He claimed that in 20 years of oil prospecting and exploration, China has tapped less than one-tenth of the basins that are promising sources of oil.

China's oil output in 1975 reportedly amounted to 562 million barrels. Peking's official New China News Agency recently claimed that in the first 11 months of 1977, crude-oil production increased 8 percent and natural-gas output rose 22.3 percent when compared to the corresponding period in 1976. But the news agency failed to disclose production figures.

Knowledgeable sources in Tokyo put China's oil production in 1977 at 1.8 million barrels a day, thus edging ahead of Indonesia. According to U.S. intelligence, more than half of this output came from the vulnerable Tachung field in northern Manchuria, which is surrounded by three sides by Soviet territory. One-tenth of total production is now believed to be exported.

China's objective is said to be to achieve a production of 8 million barrels a day by 1990.

In order for China to exploit new fields and increase output, specialized pipeline equipment is needed along with sophisticated drilling machinery and the various products necessary to assure the safety of producing wells both on-shore and offshore.

The nation is believed to have purchased some \$50 million worth of such equipment from the United States, Japan and Romania in the second half of 1977. It has recently placed an order with the Japanese Mitsui Engineering and Shipbuild-

ing Co. for two marine geophysical survey ships, with a displacement of 1,500 tons each, at a total cost of about \$16 million. The vessels will be equipped with magnetometers to detect oil, gas and other offshore resources.

These purchases are estimated to have brought the amount to more than \$360 million that Peking has spent since 1972 for this type of equipment.

At present, offshore exploration is limited to the Gulf of Po Hai, Hainan Island and undisputed coastal areas.

Preliminary seismic surveys have also taken place over a wide area, including the disputed Spratly and Paracel island groups, Taiwan, Vietnam and the Philippines, as well as China, have all laid claims to these archipelagos.

According to Japanese industry sources, Chinese oil, with a high paraffin content, has the disadvantage of requiring heavy cracking facilities for refining.

The Japanese Energy Agency estimates China's coal reserves at 100 billion tons with its coal production in 1975 at 470 million tons.

Plans for the mechanization of China's coal mines by 1978, at a cost of \$300 million in mining equipment, have been announced. There are an estimated 125 coal mines now being exploited—but much of the coal extracted, being surface coal, is reported to be of poor quality.

Recent Peking broadcasts have claimed that production at the Kailan coal mines has been restored to a 70,000-ton-per-day level. This mining complex was devastated by the violent earth-

quake of July 28, 1976 that flattened the adjoining industrial center of Tongshan, with a reported loss of 200,000 lives.

With the explosions of its own atomic and hydrogen bombs, China is known to have the technology and know-how necessary to develop nuclear-power plants. But if any of them are planned, under construction or in operation, the fact remains shrouded in silence.

On Jan. 22, Yuan Pao-hua, who was then vice-minister for the State Planning Commission, stated that China would develop its oil, coal, peat, lignite, bituminous shale and geothermal resources, but made no mention of nuclear power.

Following up on its trade agreement with the European Economic Community, Peking signed an eight-year pact with Japan in February designed to split \$20 billion equally in two-way trade. Under the agreement, Japan will gradually more than double the imports of Chinese crude from 7 million metric tons in 1978 to 15 million metric tons in 1982.

Japanese purchases of Chinese coal during the five years will range from 5.1 to 5.3 million tons of coking coal for steelmaking, and from 3.3 to 3.9 million tons of steaming coal for power generation.

In exchange, China will buy from Japan industrial plants and technology.

China is also selling oil to Thailand and the Philippines.

Little information is available on China's capacity to generate electric power, which Peking seems to regard as being of strategic military importance. However, current reports are that thermal power plants are being gradually converted from coal to oil.

—R.Y.H.

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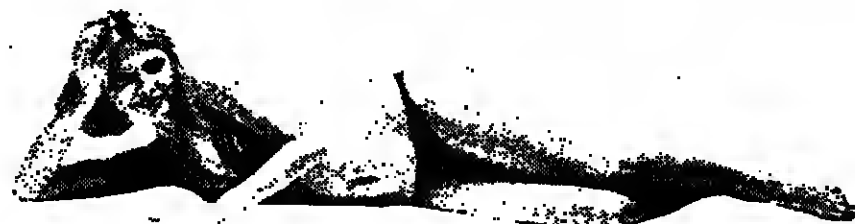
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Which little, sunny country  
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to make a solar heater...



...that works in cloudy weather too?

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# Hello, managers



If industrial plants — especially in the young industrial nations — are to be real economic assets, a transfer of know-how on a wide scale is essential. For without the well-founded skill and knowledge of man, the most sophisticated machines and the most imposing plant will grind to a standstill.

## Know-how transfer in the international plant business

The development of Europe's industry occupied a period of many decades. The know-how of the experienced plant supplier now makes it possible to condense this historic process into the space of a few years. As a result of its work on hundreds of projects in many various branches of industry, DIAG has gathered a vast fund of well-founded experience, which makes it a first-choice partner when it comes to the installation of industrial plants.

### The DIAG — concept of plant installation

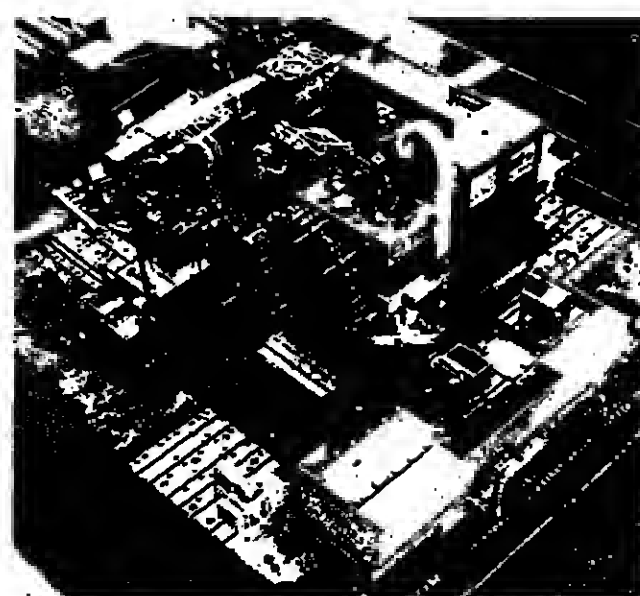
Deutsche Industrieanlagen GmbH, Berlin, known all over the world as DIAG, has been one of the great names in the international plant business for over 70 years. The secret of DIAG's success is simple: insistence on the transfer of know-how as a crucial element of successful industrialization. Based on the vast experience amassed in its own engineering production workshops, DIAG has developed a concept which makes possible the great stride from the turnkey factory to the industrial plant in full production. We have built factories in many countries on the basis of this concept — production units for machine tools, bicycles, mopeds, tractors, crawler vehicles, diesel engines, agricultural machinery, electrical household appliances, filament lamps, batteries and generators. In each individual case, the following prime requirements were given special consideration:

- Adaptation to the facilities and necessities of the client country.
- Adoption of new technologies developed during the installation of the plant.
- Training of indigenous labour to the status of skilled workmen and technicians and
- Responsibility for organization and management during the working-up phase.

and geographical conditions. All this is purely a matter of hard-won experience. DIAG experts built their first factory in China more than 70 years ago; they have been working for 50 years in Iran, 25 years in Burma and now over 10 years in Algeria. DIAG's turnover in the plant business is fast approaching the DM billion mark.

The manufacture of products with high market expectations necessitates in many cases the procurement of a manufacturing licence. But it is not every big-name licence-holder who is prepared to disclose the secrets of his manufacturing know-how. Unless, that is, the applicant has his respect and confidence...

And machine tools are the basis and the indispensable component of most industrial projects.



### 6000 trainees from 40 countries

No machine can function without people to operate it. This is one reason why DIAG has attached the greatest importance to personnel training from the earliest days. In DIAG's own training centres in Germany or in the client country, in apprentice workshops, industrial schools or technical colleges, young persons from all parts of the world are being prepared for their future vocations under the guidance of DIAG's expert technicians and instructors. Up to now, more than 6000 trainees from over 40 countries have passed through our hands.

Large-scale industrial projects call for a team of experts to take charge, from the first consultations with the client to the final transfer of the plant in full production. Of DIAG's staff of some 6000, about 2000 are technical experts occupied in the plant business.

To have his own know-how is a valuable additional asset for the plant supplier. One who has installed and organized his own manufacturing plant has a decisive advantage over other plant suppliers: The fund of expert knowledge necessary to keep a production plant functioning at top efficiency. DIAG has its own works in Germany: Fritz Werner in Berlin, Hermann Kolb in Cologne and Geb. Honsberg in Remscheid. These DIAG works manufacture some of the world's finest machine tools, from simple milling machines to articulated transfer lines.



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### Symbol for the future

Four children from four continents symbolize the future of the young industrial nations. In a series of informational advertisements in international periodicals, DIAG is drawing attention to the importance of the education of these children, the future managers, engineers and teachers of their countries. For successful industrialization is made possible only through the transfer of technical and organizational know-how. That is the central pillar of the DIAG philosophy: DIAG offers knowledge now.

## Hello, engineers



If you would like to know more about this subject, please write to us.



### Keys to success

If a plant supplier is to be successful on an international level, he must fulfil some key conditions: He must have wide experience in foreign countries, be familiar with the mentality and level of education in the client country and scrupulously observe its laws. He must adapt easily to climatic





# Israel, Dependent on Oil Imports, Looks to Solar Research

By Yuval Elizur

JERUSALEM (IHT)—With more than a quarter of a million Israeli families already dependent on solar heaters to produce hot water for household use, Israeli scientists are hoping to exploit energy generated by solar ponds for industrial use and for heating greenhouses. Even now, at Tel Aviv University researchers are driving in electric cars powered by solar energy.

However, Israeli policymakers are concerned over the fact that, despite progress made here and elsewhere in the use of alternative sources of energy, Israel is still almost totally dependent on imported oil. The nation spends close to \$700 million on oil each year. Of even greater concern is the problem of the fuel's availability. At present, Israel is dependent on several sources of oil, the most important one being in the Gulf. There is some worry here over whether all these sources will continue to supply Israel in case of an emergency or outbreak of war.

Thus, the main principle stated in the first outline of its energy policy recently drafted by the Ministry of Energy is diversification. Israel's priorities are to diversify sources of oil and other sources of energy and to concentrate on the development of new technologies. The decision-making process, the policy outline emphasizes, should take into consideration geopolitical, economic, technological, logistic and social aspects. Its main goal is to supply Israel's energy needs in the time, place, quantity and the form most needed.

Special attention will be given, the energy-policy paper adds, to securing the supply of energy in times of emergency. These energy goals will be coordinated with other national goals.

## Alma Field

On March 27 of this year, Israel started regular oil production from the Alma oil field in the Gulf of Suez off the coast of occupied Sinai. It is expected that within a few months production at Alma will reach 10 thousand barrels a day. By 1979 this local production will cover a sizable proportion of Israel's oil consumption, which is expected to exceed 7.3 million tons in the current year.

However, the Alma oil field in Sinai is included in the area that

Israel has already agreed to return to Egypt in any peace agreement between the two countries.

Israel is hoping to reduce its dependence on imported oil by increasing investments in oil exploration in various parts of Israel and by building power plants fueled by coal and nuclear power.

A plant that will be fueled by coal is presently under construction near Hadera along Israel's Mediterranean coast between Haifa and Tel Aviv. Completion is expected by 1984. The plant will supply about 1400 megawatts, about 40 percent of Israel's estimated consumption of electricity at that time.

Relatively mild protests of local residents and environmentalists against the construction of the plant on this spot have long since been overcome, but it is still not clear how the one million tons of coal a year that will be required for the project will be supplied to the station. Israel has no coal of its own and environmentalists are vigorously opposed to the plan to build a special port at Hadera, where the imported coal will be landed. Earlier plans to transport the coal by train from Haifa Port, 25 miles away, were shelved for similar reasons.

Even more in doubt are the plans to build Israel's first atomic power



Technician checks solar energy receptor and reflector in Israel.

station on the Mediterranean coast at Zikim, 40 miles south of Tel Aviv. Here the plan to build a 900 megawatt plant has been questioned for economic as well as environmental reasons.

Because of the vulnerability of

Israel's energy economy to political pressures, it was decided to create large stockpiles of oil. In 1976 the U.S. government granted Israel a \$50-million loan for the construction of underground storage facilities. However, they have not yet

been fully utilized since some of the geological surveys have proved disappointing.

Efforts are continuing to solve the technical problems involved, and the Israeli government is allocating considerable sums from its

own budget for additional research and the improvement of existing storage and transportation facilities.

The two large oil refineries at Haifa and Ashdod, about 25 miles south of Tel Aviv on the Mediter-

anean coast, are already connected by pipelines to the major consumption centers in the country.

In view of these limitations on efforts to diversify existing sources of energy, an increasing amount of attention is now being given to the development of alternative sources of energy. Among the plans is a project to build a canal from the Mediterranean to the Dead Sea, which is 1,200 feet below sea level, the lowest point on earth.

The canal would have a double purpose. The would be to save the Dead Sea, which at present receives water only from the Jordan River that flows from the north. In recent years the Jordan River has been declining rapidly because of evaporation. The second would be to utilize the downward flow of the water for the production of hydroelectric power.

## Estimates

It is estimated that the Mediterranean-Dead Sea canal could generate an average of 100 megawatts, with power production increasing to 400 megawatts in peak periods at the time when the Dead Sea will be restored to its former level.

Initial estimates of investment in the project call for an outlay of half a billion dollars. A steering committee, composed of 45 top Israeli experts, is studying the feasibility

of the project as well as various engineering alternatives.

Fifteen years ago Israel was considered one of the pioneers in research on the use of solar energy. An Israeli invention led to the improvement of solar heaters that provide warm water for home use. In solar ponds, developed in Israel, water can be brought to boiling level and used for generating electricity. An Israeli electronics company, Tadiran Ltd., with the aid of a government grant is at present experimenting on total climate control, which would provide air conditioning in the summer and heating in the winter from solar energy.

A new hospital now under construction in Jerusalem is installing huge solar heaters that will provide it with total climate control.

However, Israeli experts admit that a budget squeeze in the years that preceded the energy crisis in 1973 brought a slowdown in solar-energy research, which may have cost Israel its lead position in the field. In recent years major efforts have been made to close the gap.

In 1978 Israel will spend up to \$12 million, or about 14 percent of all budgets allotted for industrial R and D, on research in energy technology.

## Other Projects

A considerable proportion of the budgets, 60 percent of which come from government sources, will be invested in projects involving solar energy. However, there are other research projects, including the utilization of Israel's peat and oil-shale deposits and the conversion of agricultural waste to methane gas, as well as a series of industrial projects such as water desalination using a combined system of solar and gravitational energies.

Israel has also recently introduced a systematic program for energy conservation. It is believed that a series of increases in the price of oil, and especially the lifting of subsidies on the price of heavy fuel oil for industry, will induce Israeli consumers to do more to save energy.

While it is not expected that these projects will actually bring a cut in Israel's oil consumption in the next few years, it is hoped that imports will remain almost at their present level, at least for the near future.

—M.P.

# India Pins Its Future on Biogas and Solar Electricity

NEW DELHI (IHT)—No country offers quite such contrasts in its energy situation as India. One of the first countries to enter the nuclear field, it still relies on vegetable waste products, firewood, cow dung and wind power for nearly half its energy consumption.

Despite the fact that India is the world's tenth most industrial nation, its average per-capita energy consumption is only 3 percent of that of the United States. Only one-third of India's villages, where three-quarters of the 600 million population live, have access to electricity.

India's major energy sources are coal and hydroelectric power. According to a report made by the nation's Fuel Policy Committee, total gross coal reserves are 83 billion tons, of which some 29 billion are proven, while hydroelectric poten-

tial is 41,000 megawatts on the basis of only 60-percent load capacity.

Recent offshore discoveries near Bombay will increase the country's annual oil production potential to at least 20 million tons by the early 1980s—more than half the country's anticipated consumption at that time. Further discoveries may lead to self-sufficiency in the oil sector, even if it is short-lived.

The country's uranium reserves cannot support much more than 10,000 megawatts of nuclear capacity, but with plutonium fast breeders this could be increased 60 times. With the world's largest reserves of thorium at 45,000 tons, India could gain 200 times more with the thorium cycle than with the plutonium one.

What appears as an impressive battery of energy inputs becomes

meaningless to the average Indian who is lucky to earn 20 cents a day if he is in the monetary system at all. Experts say the needs are not costly centralized systems such as electricity grids or natural gas supplies, but the availability of cheap new energy installations.

After 25 years of Soviet-style development based on heavy industry, India's new government is shifting the emphasis of economic policy to developing industry and agriculture at the village level. Such a policy can be achieved only through the development of new energy sources such as solar power and biomass.

So the country has produced the strange contrast of developing a prototype fast-breeder reactor at the same time as it is turning out cheap biogas plants that can con-

vert cow dung into methane gas for cooking and lighting.

Scientists in India are working on the most sophisticated techniques in energy. In the coal field, Bharat Heavy Electricals is developing combustion-bed boilers at Tiruchirappalli and Hardwar. It is also designing a small low-value coal-gas plant and exploring the possibilities of magnetohydrodynamic (MHD) power generation. In electricity they are experimenting with new turbines.

## Villagers

At the same time, the Indians are looking to the needs of those villagers who do not know what electricity is. Research is going into the development of fast-growing trees for future firewood, the conversion of cow dung into methane and fertiliz-

ers with biogas units, the production of smokeless coal as a cooking fuel and the utilization of solar energy for cooking, crop drying, water heating, refrigeration, water pumping and electricity generation.

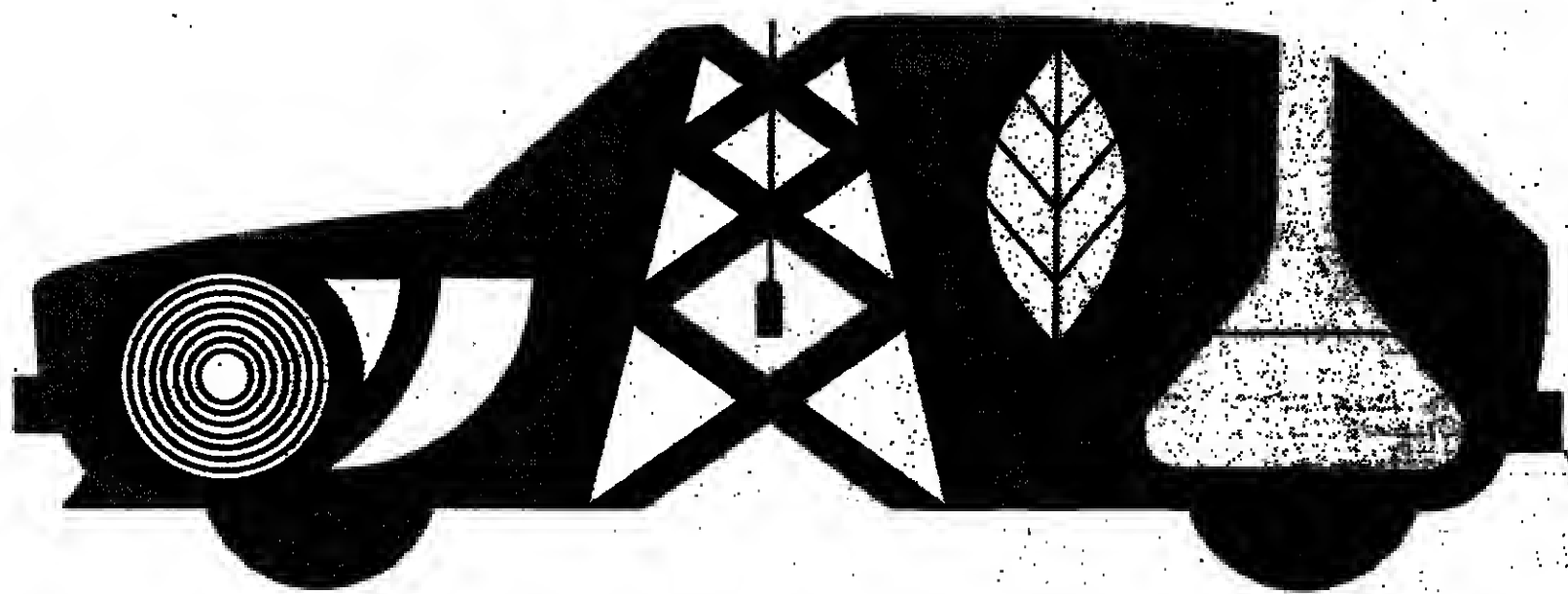
A whole range of solar cookers has been developed at the Central Arid Zone Research Institute at Jodhpur, with the cheapest unit costing only \$10. A 10-ton-per-day paddy drier has been developed by the National Indian Development Corp. in Ludhiana, while the Indian Institute of Technology is developing a refrigeration unit for agricultural products.

A hotel in New Delhi heats its swimming pool with solar energy, a 10-kilowatt solar-power plant is being built in Madras in an Indo-German venture, and Central Elec-

tronics is about to bring out India's first photovoltaic panels.

The National Physical Laboratory in New Delhi is even working on a turbine driven by solar energy vapors.

However, the symbol of India's rural energy policy has been the biogas unit. Whereas until now the peasants have burned dry cow dung—which damaged their eyes, wasted fertilizer content and gave only poor-quality fuel—the Khadi and Village Industries are building cheap converters that will provide enough gas from two or three cows for cooking and heating water, lighting and extracting valuable fertilizers for an entire family. Many Indians believe it is through the biogas unit and solar-electricity generator that economic development will come to the rural poor.



## Raw Material Reserves.

From time to time, scientists and statisticians tell us how long it will be before we have used up the world's natural resources. We are obliged to take these limits seriously, since we have so far discovered no means of replacing the raw materials and energy sources we use today. If they were to run out, our very existence would be threatened. But we have one well-tried weapon in the fight against shortages and

hardship: our spirit of research and invention. At VW, for example, we are investigating totally new propulsion systems which harness different forms of energy to the needs of individual transportation. Pipe dreams, perhaps, at the moment. It is more important right now for us to husband available reserves until these new solutions are ready for use. We are doing everything in our power to preserve the freedom of

private motoring for as many people as possible. We recycle waste products into our production processes wherever this is economically feasible. We have developed engines that make the most economical use of either petrol (gasoline) or diesel oil as a fuel—and we even supply these engines to other leading automobile manufacturers. More significant still, perhaps—today's Volkswagens weigh less than yesterday's.

A 1967 Beetle weighed 800 kg (1764 lb), whereas a 1976 POLO tips the scales at only 685 kg (1510 lb). Does less weight have to mean reduced safety? This might have been the case if safety research and development had stood still. But thanks to the new concepts produced by our engineering team, today's VW models can meet and surpass the most stringent safety regulations. Tackling and solving all these prob-

lems hasn't exactly made building cars any easier for us. But it has meant a vast contribution to meeting future problems arising from raw materials and energy shortages. And it has proved again that human initiative is the greatest energy reserve that mankind possesses.







# Arabs Counting on More Calories, Not Alternative Sources

By Joseph Fitchett

BEIRUT (JHT)—The oil-producing states—beneficiaries of the world's hunger for energy—are concentrating on how to squeeze more calories out of their hydrocarbon resources rather than on how to develop alternative sources of energy.

This strategy is hardly surprising. By improving recovery rates in existing oilfields, OPEC countries can stretch their own profitable consumer and also lift the planet's energy horizon. Another growth factor in the world energy equation is the improved exploitation of natural gas, which until now was a distinctly poor relation of oil.

OPEC analysts are deeply skeptical about the industrial countries' determination either to curb their consumption of oil or to seriously pursue the development of alternative sources—at least until the price of oil doubles. A figure often quoted as an effective incentive is \$20 to \$25, in constant dollar terms, compared

to the 1978 price of under \$13 a barrel.

Once this threshold of economic incentive is reached, OPEC analysts say, the search for an alternative will then be financially viable and the future of oil sales will be seriously threatened. So far, however, the costs of alternatives have tended to rise along with oil-price increases, albeit more slowly. So OPEC governments have concentrated on technology applied to oil production—in other words energy conservation practiced at the source.

## Natural Gas

They have made significant headway. The major breakthrough is the utilization of natural gas, which used to be conspicuously wasted. Often occurring in association with oil (in fact, gas mixed with oil provides the pressure to force it out of the ground), gas surfaces simultaneously with the crude oil and has to be disposed of.

In the Middle East, where the gas had nowhere to be piped to, the associated gas was mostly burned

off or flared. The giant flaming gas jets illuminated the night skies and left black smudges on the sand in daylight. As oil production increased in the 1970s, more oil and gas were pumped and the percentage of gas wastage increased.

This waste is ending. The new economics of energy have spurred most oil-producers to launch giant gas-gathering schemes to harness their natural gas instead of flaring it. Until now, this gas was too far from any consumer market for it to be marketed profitably. However, the leap in oil prices has meant that gas, as a "cheap" energy source, is being used locally for utilities (Kuwait, for instance, is switching its power/desalting plants to gas from oil) or else as a power and/or feedstock for locally built industry.

At the same time, natural gas in the Middle East is starting to be exported long distances to industrial countries' markets.

The technology of gas exports varies. Saudi Arabia, for instance, already the world's largest oil exporter, intends to keep its high-intensity methane gas for its own

industrialization. At the same time, it has abundant other gas resources which will be processed into liquid petroleum gas (LPG) for easy shipment. This LPG, which includes such products as butane, can be adapted for individual heating and cooking and for some petrochemical purposes. Saudi Arabia intends

to be the world's biggest LPG exporter in the 1980s accounting for about one-third of international LPG trade.

## Long Pipeline

Similarly Iran—whose vast gas reserves include some non-associated gas expected to outlast Iranian

oil—is expanding its massive triangular gas deal with the Soviet Union and Europe. Using the longest gas pipeline in the Middle East, soon to be twinned with a new one under construction, Iran sends nearly 1.3 billion cubic feet of gas daily over the Soviet border; in turn, the Soviet Union sells some

gas from its own fields to Western and Eastern Europe. Algeria is the leader among the oil states heavily committed to gas development (and talking about forming a cartel to do for gas prices what OPEC did for oil prices). This North African state is investing upwards of \$20 billion in its bid to become a major gas-exporting nation.

Plans are going ahead for the construction of an undersea gas pipeline from Algeria to Western Europe. It will run through Tunisia and then along the seabed across the Mediterranean into south Italy and later possibly beyond. However, the new technology of which Algeria has become the leading proponent is liquefied natural gas (LNG), a technique which contracts the gas volume 600 times for economic shipment.

This liquefaction process entails chilling the gas to minus 160 Celsius. Many forecasts of international energy availability in the coming decade already accept this technology as a success. However, the liquefaction process—entailing chilling the gas to minus 160 degrees Celsius—has some drawbacks. It is expensive. A liquefaction installation easily can top \$1 billion since it must include a liquefaction "train" to refrigerate the gas, a pipeline to bring it (in Algeria's case, several hundred miles to the LNG terminals at Skikda and Arzew) and special cryogenic tankers (mainly built at La Ciotat in France).

Safety is another potential problem. The LNG tankers amount to

floating Thermos jugs: the liquid gas in the special spherical tanks is so intensely cold that a single drop of it which leaked could cause a ship's decks to become brittle and fracture. Although a major accident has never occurred, theoretically the escaping gas would freeze the surrounding sea, then form a lethal gas cloud by evaporation.

Besides cost and safety, Algeria has encountered a special problem in the form of long delays in its original contracts in the United States (the main intended market for Algerian gas) due to time-consuming government reviews of sales. After successfully passing lengthy hearings by regulatory agencies, an initial Algerian contract was finalized at a very low price, but others suddenly were confronted with the newly-created U.S. Department of Energy. Now the DOE has announced it can only rule on further Algerian gas imports once it adopts an overall U.S. policy on imported energy.

Japan, in contrast, already is relying on natural gas imported from the Middle East, notably LNG from Abu Dhabi. Under a 20-year contract, LNG from the newly-completed facility on Das Island is supplying the Tokyo Power Co., the world's largest public utility.

## Expanded Role

The application of new technology is giving gas a newly expanded role of another kind in the Middle East energy picture—as the product used in secondary recovery. By reinjecting gas (or seawater in some cases) into oil fields, engineers can boost the declining pressure in the reservoirs and thus ensure that a greater proportion of the oil there is pumped out of the ground.

In fact, for instance, hopes in this fashion to raise its estimated reserves from 60 billion barrels of oil to 80 billion barrels—a 30 percent expansion in its effective oil reserves in its existing fields.

Secondary recovery by reinjection has become a matter of policy in Saudi Arabia and in the United Arab Emirates.

In all the oil-producing states, governments have become increasingly sensitive about the future of their oil fields as these resources have been taken over from the multinational oil companies and reeked in value. The new owners are determined to see their oil is good to the last drop.

# Japan Plans for Post-Oil Era With Sunshine Project

By Robert Y. Horiguchi

TOKYO (JHT)—When Japan reeled under the impact of the rise in oil prices in 1973, officials in the Ministry of International Trade and Industry promptly called for a program for national survival in the post-petroleum age. They named it the Sunshine Project.

As the name indicates, its principle objective is harnessing solar power. The project also provides for the development of geothermal energy, research into coal liquefaction and gasification processes, hydrogen generation by electrolysis and other methods such as using the movement of waves and the difference in temperatures at various sea levels. The ultimate objective is the development of nuclear fusion at the outset of the next century.

In the wake of the near panic that followed the oil crisis, the Sunshine Project was quickly approved by the Diet and funded. The ministry has so far commis-

sioned nine private companies in the fields of construction and domestic electric appliances to develop solar housing systems for air conditioning and heating homes.

If a suitable system can be developed at a price within reach of the average home owner, MITI estimates that when a million homes come to use a solar appliance, it will result in an annual saving of 279 million barrels of oil.

## Cloudy

Solar cooling and heating systems costing \$11,000, which generate 1 kilowatt hour per square meter of solar panels on a clear day, are available. However, because of the number of cloudy and rainy days here, the average generating capacity is 0.16. At that price, a solar system costs two-to-three times as much as an oil-fueled central heating and cooling system, but it would pay for itself in 10 years.

MITI's target price for such a so-

lar system is \$3,700 for a house with 99 square meters of floor space.

Another development is in solar batteries. These cost from \$90 to \$136 to generate one watt of power, compared with 68 cents to \$1.36 of the overall cost to generate the same amount of power in a nuclear plant. MITI would like to see this solar battery cost cut to one-tenth of its present price by the year 2000.

Engaged in this research is the Japan Solar Energy Co., Ltd. in which the Matsushita and Sharp companies, Japanese electronic manufacturers, have joined forces with Mobil Oil and Tyco Laboratories.

Two Tokyo University researchers have reported success in producing hydrogen from water by exposing it to the sun's rays. The process uses semi-conductors of platinum and titanium oxide. They have so far been able to extract 3.5 liters of hydrogen a day. The device

has a maximum capacity of seven liters of hydrogen per day.

A wave-operated electric power generating plant is scheduled to undergo tests this July. It consists of an 80-meter-long, 500-ton barge-like vessel carrying three generators that are activated by turbines run by compressed air created from wave movements. By 1979, this device is expected to be able to produce 1,000 to 2,000 kilowatts per hour.

## Mirrors

A pilot solar energy power plant with a capacity of 1,000 kwh, developed by the Mitsubishi Co., is also undergoing tests. It consists of 792 reflecting mirrors that direct solar heat to a collecting device atop a tower where it is converted into steam which operates a turbine generator.

Among the more ambitious projects under study, based on a high-temperature gas-cooled reactor, is an atomic-powered steel mill. Re-

search on this is being carried out by the Agency of Industrial Science and Technology in association with the Japan Energy Research Institute and 15 major corporations.

This project for a direct steel-making process using high-temperature reducing gas is expected to reach its initial planning stage in 1980. It calls for the production of reducing gas from asphalt using a 50,000-kilowatt, high-temperature gas-cooled reactor with a thermal exchanger capable of handling 1,000 degrees Celsius.

A pilot low-calorie coal-gasification plant for generating electric power has been put into operation using five tons of coal a day, while a 7,000-cubic-meter high-calorie coal-gasification plant is now on the planning boards.

Plans are also being drawn up for the construction of a gas-liquefaction plant with a capacity of one ton a day.

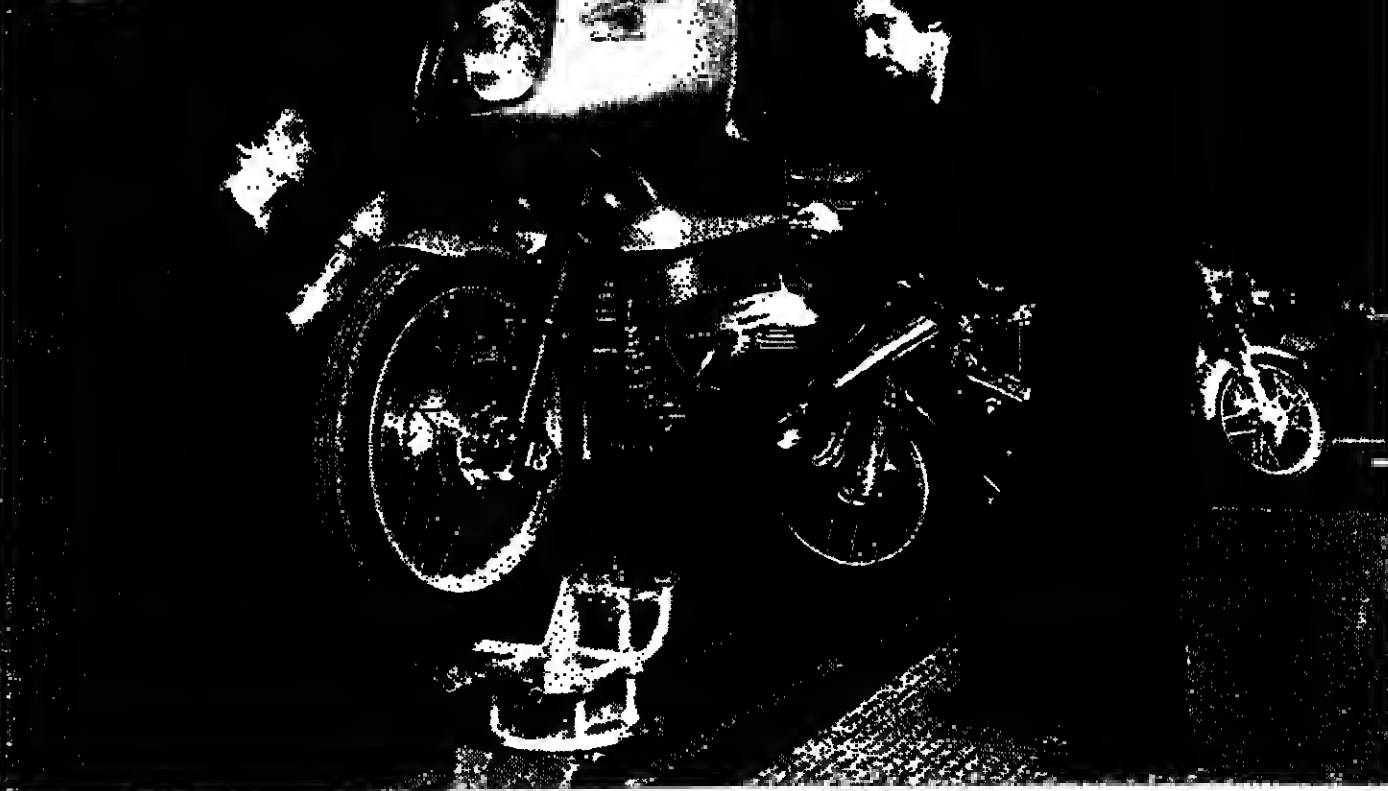
A parallel project, dubbed the Moonlight Program, has also been

launched by MITI. It will concentrate on research for the development of a high-efficiency gas turbine, an electro-magnetic fluid electricity generating system and waste heat utilization.

In spite of the volcanic nature of the country's terrain, efforts to tap geothermal energy were limited until recently. In 1975, geothermal power generation was limited to five localities, with a total output of 50,000 kwh. This has now been doubled with the operation of a geothermal power plant with a capacity of 50,000 kwh at Kakkonda, in the northern part of the island of Honshu. Its operator, the Tohoku Electric Power Co., claims that it will be sufficient to meet 70 percent of household power demand in Morioka, a city with a population of 250,000.

The government's target is to generate 1 million kwh from geothermal energy by 1985 and 3 million kwh by 1990.

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## invest—produce in Berlin

# Power

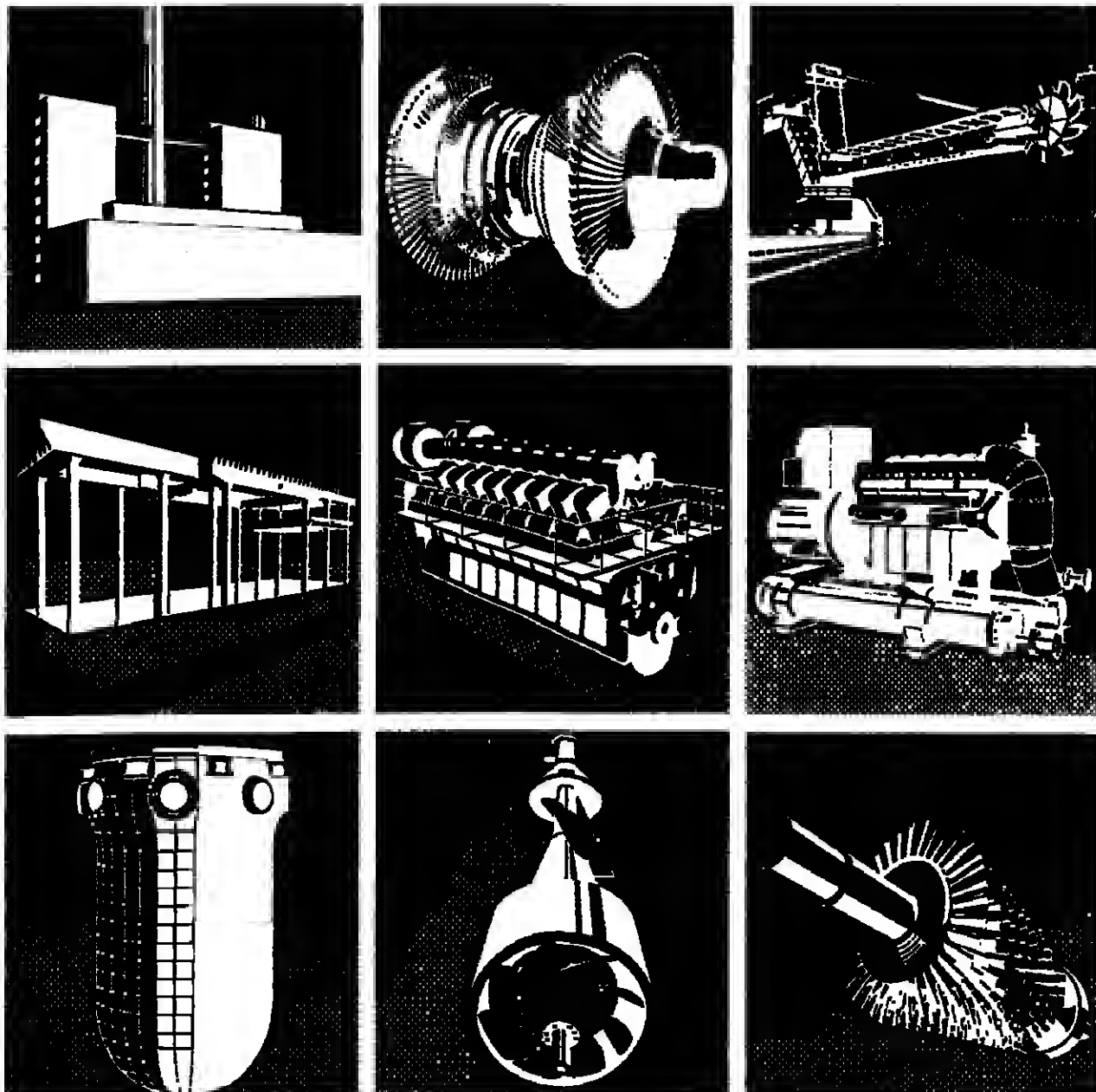
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